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EXTINCT SPECIES OF AMERICAN OX.

(FROM THE SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE, VOL. V.)

DESCRIPTION

OF AN

EXTINCT SPECIES OF AMERICAN LION:

FELIS ATROX.

A MEMOIR

ON THE

EXTINCT DICOTYLINÆ OF AMERICA.

FROM THE TRANSACTIONS OF THE AMERICAN PHILOSOPHICAL SOCIETY, VOL. X.

BY JOSEPH LEIDY, M. D.

PHILADELPHIA;
1852.

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MONACENSIS.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

MEMOIR

ON THE

EXTINCT SPECIES OF AMERICAN OX.

BY

JOSEPH LEIDY, M.D.

[ACCEPTED FOR PUBLICATION SEPTEMBER, 1852.]

VOL. V.

ART. 3.

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

PAUL B. GODDARD, M. D.,
JOSEPH PANCOAST, M. D.

JOSEPH HENRY,
Secretary S. I.



INTRODUCTION.

Fossil remains of the ox tribe have been frequently discovered in the United States, of which descriptions, scattered through various works, have been given; but no approach to a correct view has been obtained of the number and character of the extinct species. The author, having the best opportunity of inspecting most of the specimens which have been described, has availed himself of it to give in this Memoir as clear a history of the animals as the remains would justify. In this endeavor, he has been very much assisted by the examination of additional specimens, in the cabinets of the American Philosophical Society and Academy of Natural Sciences of Philadelphia; and others, loaned with the utmost liberality by the Boston Natural History Society; Prof. Samuel St. John, of Hudson, Ohio; Mr. J. W. Foster, and Mr. Thomas Kite, of Cincinnati; to all of whom he now expresses his sincere thanks.

The ox tribe is surpassed by no other in economical importance to man, and it is also one of peculiar interest to the naturalist and geologist. The existing species are numerous, and are indigenous to all the continents excepting South America and Australia.

America, at the period of its discovery by Europeans, possessed no indigenous species of horse; although the New World presented such favorable conditions to the existence of this animal, that, a few years after its introduction, it formed large herds, now found in a wild state. This is a remarkable fact, especially as recent researches have proved the former existence of at least two species in North and South America.

The non-existence of any species of ox indigenous to the latter continent is, however, still more remarkable; for, not only are the conditions so favorable to its development at the present time, that the Domestic Ox introduced by Europeans exists in immense herds upon the extensive pampas in a wild state, but there are also found two species indigenous to North America. Nor have any remains of extinct species of ox been found in South America, while such have been discovered in North America, indicating the former existence of three and probably four

species; and it really appears as if circumstances had always been absent upon the former continent, which have been at least coincident with the primitive origin of the ox tribe in other countries.

Of Australia, we know too little to say positively no species of the ox tribe has ever existed there *ab origine*; and it would probably even be unsafe to infer from a view of its recent fauna that there did not.

The two recent species of ox of North America are the *Bison Americanus*, Gray, and the *Ovibos moschatus*, Blainville.

When North America was first colonized by Europeans, the *Bison Americanus*, or Buffalo, ranged over nearly the whole continent; but it has gradually retired westward in advance of the migrating column of the white race of man, until it has entirely disappeared east of the Mississippi. To find it now, in large numbers, it is necessary to travel far west of the latter, even to the foot of the Rocky Mountains; and the day is not far distant when it will become quite extinct, unless protected by a munificent republic, as has been done by the Emperor of Russia in the case of the Aurochs, or European Bison, now kept in great herds in certain forests of Lithuania.

The *Ovibos moschatus*, or Musk Ox, is rarely seen by travellers and naturalists, being confined to that part of America west of Hudson's Bay, and north of 65° of latitude, to which climate it is peculiarly adapted by its thick long fleece.

A fine specimen of this animal, preserved in the British Museum, we are informed is the only one contained in any collection of Europe or this country.

CHAPTER I.

GENERAL REMARKS.

§ 1. FOSSIL REMAINS OF THE AMERICAN BUFFALO, *BISON AMERICANUS*.

REMAINS of the American Buffalo are frequently discovered within the circuit of its former habitation east of the Mississippi, more especially at that remarkable cemetery of mammalia, Big-bone Lick, Kentucky. Mr. Lyell, in the description of a recent visit to this locality,¹ remarks that, within the memory of persons now living, the Buffaloes crowded to the springs of Big-bone Lick; but they have retreated for many years, and are now as little known to the inhabitants as the Mastodon itself. In reference to the same place, he observes he saw remains of the Buffalo in great number in a superficial stratum cut open in the bank of the river.²

In the Museum of the Academy of Natural Sciences there is a collection of bones from Big-bone Lick, which I do not hesitate to attribute to the Buffalo; although, from no recent skeleton, excepting crania, of this animal being accessible for comparison, I cannot positively ascertain their identity.

The specimens are as follow:—

1. Fragment of the left side of the lower jaw, containing the last molar tooth.
2. Fragment of the left side of the lower jaw containing four teeth, from an old individual.
3. The occipito-parietal and temporal bones of a young individual.

These three specimens were presented to the Academy by Dr. Richard Harlan.

4. Two superior molar teeth; presented by Thomas Fisher, Esq.

Besides the foregoing, there are numerous bones from Big-bone Lick, presented by Thomas Jefferson to the American Philosophical Society, and now on deposit in the museum of the Academy. The specimens are dark-brown or black in color, with a lustrous surface, and are dense and unaltered in their texture. The interior of the long bones is filled with a hard, dry, pulverulent, chalk-like adipocire.

They are as follow:—

1. A dorsal and a lumbar vertebra, and a sacrum of five pieces belonging to an individual not quite adult. They are about the size of those of the Domestic Ox. The epiphyses are separated from the bodies of the two vertebræ and lost. The pieces of the sacrum are firmly anchylosed together, but the first piece has lost its anterior epiphysis.

¹ Travels in North America (1845), vol. ii. p. 55.

² Ibid. p. 56.

2. A radius about as large as in the common ox.

Length internally		11½ inches.
Breadth of proximal articulation		3½ "
" distal "		3¼ "
Circumference at middle		4½ "

3. Two metacarpals of the right and left foot of two different individuals, about as long as, but broader than in the common ox.

Length		8 inches and 8 inches 3 lines.
Breadth of proximal articulation	2 " 11 lines and 3 inches 1 line.	
" distal "	3 " and 3 inches 3 lines.	
Circumference at middle		5 " 2 lines and 5 inches 7 lines.

4. Three metatarsals about as long as in the common ox, but narrower.

Length		9 inches 3 lines.
Breadth of proximal articulation		1 inch 10 "
" distal "		2 inches 3 "
Circumference at middle		3 " 11 "

5. Six first phalanges about 2½ inches long.

6. Five second phalanges measuring from 1¼ to 1½ inches in length.

§ 2. GENERAL HISTORY OF THE REMAINS OF EXTINCT SPECIES OF AMERICAN OX, WHICH HAVE BEEN PREVIOUSLY DESCRIBED.

Remains of extinct species of ox are also quite abundant in the post pliocene deposits of North America.

The first distinct species of extinct American ox was announced to the world by Mr. Rembrandt Peale.¹ It was established upon a fragment of a cranium with a portion of one horn-core attached, which was discovered in the bed of a creek falling into the Ohio River, twelve or fourteen miles north of Big-bone Lick, and was presented to the American Philosophical Society by Dr. Samuel Brown, of Kentucky, and is now deposited in the museum of the Academy of Natural Sciences.

Notwithstanding the greater size of the specimen as compared with the corresponding part of the skull of the Aurochs, Cuvier, who subsequently described a cast of it sent to the museum at Paris by Mr. Peale, considered it as having belonged to the same species,² and in this view he has been generally supported by succeeding writers on the subject. It is, however, exceedingly doubtful, abstractly, whether the same species of Aurochs was ever common to the eastern and western world; and in the absence of any correct evidence to favor such a view, Dr. Harlan

¹ Account of some Remains of a Species of gigantic Oxen found in America and other parts of the World, by Mr. Rembrandt Peale. Philosophical Magazine (1803), vol. xv. p. 325, pl. vi. The latter is a good representation of a posterior view of the specimen.

² Ossem. Foss. ed. 4, t. vi. p. 287.

was quite justifiable in proposing for the animal to which the fragment under consideration belonged, the name of *Bos latifrons*.¹

In the *American Journal of Science* for 1846,² Dr. W. M. Carpenter described a portion of a fossil ox skull, and a molar tooth of an old individual, found on the banks of the Brasos River, near San Felipe, Texas, which appear to belong to the same species as that just indicated.

A second species of extinct ox was established, by Dr. Wistar, in the year 1814, upon part of a skull with both horn-cores nearly entire, found at Big-bone Lick.³ This specimen, and many other remains of mammalia, were obtained through the exertions of Thomas Jefferson, in his zeal for the advancement of science, and presented by him to the American Philosophical Society, which subsequently deposited them in the museum of the Academy of Natural Sciences, that they might be accessible to the inspection of all persons visiting Philadelphia.

To the species indicated by Wistar, Dr. Harlan afterwards gave the name of *Bos bombifrons*.⁴

Mr. William Cooper, in a communication entitled "Notices of Big-bone Lick,"⁵ observes, that he found a second head of this species among a collection of bones discovered by Mr. Finnell at Big-bone Lick, much in the same state as that figured by Dr. Wistar.

A third extinct species of ox found in North America was first indicated by Dr. De Kay, from a fragment of a skull with portions of both horn-cores attached, which was ejected by the shock of an earthquake in 1812, at New Madrid, on the banks of the Mississippi, and was presented to the Lyceum of Natural History of New York by Dr. S. L. Mitchell.⁶

Under the impression that the specimen belonged to the same species of ox as two crania described by Pallas,⁷ and a third by Ozeretskovsky,⁸ for which no name had been proposed, Dr. De Kay designated this as the *Bos Pallasii*, and provisionally referred his specimen to the same species;⁹ which is, however, without doubt, incorrect, as will be seen hereafter.

Mr. Cooper states that, during his stay at Big-bone Lick in 1828, a mutilated skull of this species was found at that place and brought to him, and is now deposited in the collection of the Lyceum of Natural History. He also adds he saw another specimen of the same species from Ohio.¹⁰

¹ Fauna Americana, p. 273.

² Trans. Amer. Philos. Soc. n. s. vol. i. p. 381.

³ Am. Month. Journ. of Geol. vol. i. p. 173.

⁴ Nov. Comment. Petrop. vol. xvii. p. 606.

⁵ An. Lyc. Nat. Hist. vol. ii. p. 291.

⁶ N. S. vol. i. p. 245.

⁷ Fauna Americana, p. 271.

⁸ An. Lyc. Nat. Hist. vol. ii. p. 280.

⁹ Mém. Acad. de St. Petersb. vol. iii. p. 215.

¹⁰ Am. Month. Journ. of Geol. vol. i. pp. 173, 174.

CHAPTER II.

DESCRIPTIONS OF EXTINCT SPECIES OF AMERICAN OXEN.

BISON, HAM. SMITH.

IN the skeleton of the genus *Bison*, the skull presents the most important characters, by which it may be distinguished from *Bos* and extinct species may be recognized. As in *Bos*, the horn-cores are on a level with the orbits behind, but they come off an inch or more in advance of the inion. In *Bison*, the forehead is broad, quadrate, and slightly convex. It has no trace of lachrymal fossæ.

BISON LATIFRONS, LEIDY.

- Great Indian Buffalo*, PEALE: Philos. Mag. Vol. XV. p. 325, Pl. VI.; Hist. Disq. on the Mammoth, p. 84.
 ———, FAUJAS-SAINT-FOND: Essai de Geol. I. 347; An. du Mus. II. p. 192.
Aurochs, CUVIER: An. du Mus. Vol. XII. p. 382, Pl. 34, Fig. 2; Ossem. Fos. IV. p. 50, Pl. III. Fig. 2;
 Ed. 4, t. 6, p. 287, Pl. CLXXIII. Fig. 2.
Bos latifrons, HARLAN: Fauna Americana, p. 273; Med. and Phys. Researches, p. 276; Edinb. New
 Philos. Journ. XVII. 359; COOPER: Amer. Month. Journ. of Geol. Vol. I. p. 174; DE KAY: An. Lye.
 Nat. Hist. of New York, Vol. II. p. 286; New York Fauna, Zool. Pt. 1, p. 110.
Urus priscus, BOJANUS: Nov. Act. Acad. Nat. Cur. XIII. 427.
Great fossil ox, GODMAN: Amer. Nat. Hist. Vol. III. p. 243, Pl.
Bos priscus, H. v. MEYER: Nov. Act. Acad. Nat. Cur. XVII. p. 141; GIEBEL: Fauna d. Vorwelt, I. p. 153.
Fossil ox, CARPENTER: Am. Journ. of Science, n. s. Vol. I. p. 245.
Bison latifrons, LEIDY: Proc. Acad. Nat. Sci. Vol. VI. p. 117.

The *Bison latifrons* is established upon the fragment of cranium before referred to, presented by Dr. Samuel Brown to the American Philosophical Society.

The specimen consists of the hinder portion of the cranium with a fragment fourteen inches in length of the left horn-core (Plate I.), and indicates a species as large as the existing Arnee, or Buffalo (*Bubalus buffelus*, GRAY), of India and Java.

The sutures of the remaining bones of the specimen are anchylosed; but the positions of the frontal and fronto-parietal sutures are yet distinguishable as slightly elevated zigzag lines (Fig. 1).

The form of the cranial fragment with its attached portion of horn-core is almost a repetition of the corresponding part of the skull of the Buffalo.

The base of the horn-core is situated five inches in a curved line outwards and forwards, or two inches and a half in a straight line, in advance of the position of the occipito-parietal crest.

The forehead is slightly more flat antero-posteriorly than in the Buffalo, arising from the occipito-parietal crest, being a little less below its level.

The lateral margins of the inion are broken away in the specimen; but the

remaining portion exhibits the same appearances in detail as in the Buffalo, though in an exaggerated degree corresponding to its much greater size (Fig. 2).

The base of the specimen is very much broken, but that which is preserved indicates the form to have been the same as in the last-mentioned animal.

The occipital condyles are alike in both, and, at their anterior part, advance in a concave manner to the posterior muscular protuberances of the basilar process. Between the condyles and paramastoid, a large deep fossa exists, having at its inner side the foramen condyloideum.

The foramen magnum occipitis is slightly wider than high, being two inches one line by one inch eleven lines.

The basilar process in the fossil, at its posterior muscular protuberances, is four inches wide and two inches and a quarter at those joining the body of the sphenoid.

The os tympanica has been large and inflated, as in the Buffalo, and a portion of one glenoid articulation remaining in the specimen presents the same form as in the latter.

Measurements.

Breadth of forehead between the bases of the horn-cores	. 15 inches.
Height of theinion from the upper edge of the occipital foramen	. 5½ "
Circumference of the horn-core at its base	. 20½ "
Circumference of the horn-core ten inches from its base	. 17½ "

As before observed, the fragment of a fossil ox head and molar tooth, described by Dr. W. M. Carpenter, also belong to the *Bison latifrons*.

The cranial specimen, Dr. Carpenter states, consists of the frontal bone with portions of the horn-cores. From one broken extremity of the latter to the other, the measurement is fifty-six inches; the right portion being two feet, the left eighteen inches in length. The base of the horn-cores is seventeen inches in circumference, and at the distance of eighteen inches from the head fourteen and a half inches. The frontal bone is nearly plane, and between the horn-cores, which arise laterally from the same level, is fourteen inches in breadth. The horn-cores are nearly cylindrical; and from the wood-cut representing the specimen, are directed outwards, a little backwards, and slightly upwards.¹

The tooth found with the above specimen, Dr. Carpenter observes, is a second true molar of the upper jaw of the left side. The crown is worn down nearly to the fangs, and the characteristic ruminant triturating surface is nearly obliterated. The antero-posterior diameter of the crown is a little over an inch and a half, and the transverse diameter is an inch and a sixth.

In the cabinet of the Academy of Natural Sciences there are preserved five molar teeth, about one-third larger than those of the Buffalo, which I am disposed to consider as having belonged to the *Bison latifrons* (Plate II., Figs. 2—7).

¹ Dr. Carpenter says "forwards," but, from the cut, he evidently means upwards.—*Am. Journ. of Sci.* vol. i. 1846, p. 245.

All the specimens are from the vicinity of Natchez, Mississippi. Two of them were found by Dr. M. W. Dickeson in association with remains of *Mastodon*, *Equus*, *Ursus*, *Cervus*, *Megalonyx*, and *Myiodon*; the others belong to the American Philosophical Society, to which they were presented by W. H. Huntington, Esq., who discovered them in association with remains of *Mastodon*, *Equus Americanus*, and the jaw of *Felis atrox*, described by me in the Transactions of the latter Society.

Three of the teeth are superior molars; one, the last of the series (Plate II., Fig. 4), is unworn, the others are moderately so. The inferior molars are both the last of the series; and one is unworn, while the other is worn down within half an inch of the fangs, which are elongated, as is ordinarily the case in the teeth of old ruminating animals.

In the upper molars the external side exhibits six folds relatively not more prominent than in the common ox. Internally between the principal lobes, the accessory column is very well developed and robust (Figs. 2, 4). The crescentic enamel pits or islands of the grinding surface are more simple than in the ox, and appear relatively more capacious as a result of their greater simplicity or less degree of inversion of the sides of the pits (Fig. 3).

The last lower molar (Fig. 5) also presents a well-developed accessory column between the anterior pair of principal lobes externally, and in the worn down specimen (Figs. 6, 7), upon the triturating surface forms a correspondingly larger fold. In the unworn specimen, the summit of the posterior lobe bifurcates anteriorly, one portion joining the postero-internal fold of the middle lobe, the other the postero-external angle of the same lobe.

Admeasurements of the Teeth.

Unworn superior last molar :

Length	36 lines.
Antero-posterior diameter externally	20½ "
Transverse diameter at the middle of the tooth anteriorly	14 "
Transverse diameter at bottom	17 "

Two superior true molars, probably first and second :

Length	30 and 33 "
Antero-posterior diameter	18 "
Transverse at middle	13 "

Unworn inferior last molar :

Length	36 "
Antero-posterior diameter	25 "
Transverse	9½ "

Worn inferior last molar :

Length of crown	6 "
Antero-posterior diameter of triturating surface	25 "

This last specimen appears somewhat water-worn and rolled. A portion of the anterior fangs are broken off, and the posterior, which is now fourteen lines long, is partially worn away.

J. Hamilton Couper, Esq., of Darien, Georgia, presented to the Academy of Natural Sciences an os humeri and a tibia found in excavating the Brunswick Canal, in Georgia. The specimens are well preserved in their texture, are hard and lustrous, and brown in color. The former has its upper extremity broken off, and the head of the tibia is somewhat mutilated. They belonged to a species of ox considerably larger than the Buffalo, and probably belong to the *Bison latifrons*.

The os humeri is of the right side, and measures nine and a half inches in circumference at the middle of its shaft, and four and a half inches in breadth at the condyles.

The tibia, also of the right side, anteriorly, from the summit of the spinous process of its proximal articulation, is eighteen inches in length, and the distal articulation is three and a half inches in breadth.

Mr. Couper also presented to the Natural History Society of Boston, an atlas and a metatarsus of an extinct ox found in the same locality as the preceding specimens. They have been kindly loaned to me by the Society, for examination. They are perfect, are dense and heavy, and black in color, and if they do not belong to the same individual as those just described, they, at least, probably belonged to the same species.

The atlas is about one-fifth larger than in the common ox, but it does not fit the condyles of the specimen, which has been described, of the cranium of *Bison latifrons*, being a little too small. Its exact measurements are as follow:—

Breadth transversely	9½ inches.
Breadth of transverse processes; greatest, obliquely and antero-posteriorly	6 “
Diameter of the spinal canal posteriorly, nearly	2½ “
Depth from spinous process to front tuberosity of the body	4½ “

The metatarsus is of the right foot, and is about an inch longer than those attributed to the Buffalo from Big-bone Lick, and is one-third more robust. Its measurements are as follow:—

Length	10½ inches.
Breadth of proximal articulation	2½ “
“ distal “	3 “
Circumference at middle	5½ “

BISON ANTIQUUS, LEIDY.

Proc. Acad. Nat. Sci. Vol. VI. p. 117.

This species is proposed with some hesitation upon the greater portion of a right horn-core, with a small fragment of the os frontis attached (Plate II., Fig. 1). The specimen indicates an animal intermediate in size to the recent *Bison Americanus* and the *Bison latifrons*, as characterized in the preceding pages. It was found at Big-bone Lick in association with remains of the recent Buffalo, and belongs

to the Jefferson collection deposited by the American Philosophical Society in the cabinet of the Academy.

The specimen is rather too small to determine positively whether it is a distinct species or not from *Bison latifrons*. It did not belong to an aged individual, as the suture is still open between the frontal bone and that portion of the parietal which forms the upper boundary of the temporal fossa. It belonged to a species of *Bison*, as indicated by the advanced position of the horn-core, and resembles more the corresponding part in the *Bison priscus* of Europe, as represented by Cuvier and others, than it does that of *Bison latifrons*. The horn-core is more abruptly conoidal, and relatively more curved than in the latter. It is not improbable, however, that the fragment may have belonged to a female of *Bison latifrons*. The only characteristic measurements to be obtained from it are as follow:—

Length of the fragment of horn-core	10 inches.
Circumference on a line with the basal margin inferiorly	14½ “
do. five inches from the basal margin superiorly	10 “

BOOTHERIUM, LEIDY.

This is a new genus proposed in the Proceedings of the Academy of Natural Sciences, upon two species of extinct ox of North America. Its diagnostic characters, so far as they have been ascertained, are distinct, and briefly as follow:—

1. The os frontis rises into a hump, or forms a prominent process, from the sides of which arise the horn-cores.
2. The latter arise above and posterior to the orbits, but considerably in advance of the inion, and curve downwards in their course, but do not turn up at the tips, as in *Ovibos*.
3. The species possess lachrymal depressions, or larmiers, as well developed as in cervine animals.

Bootherium is closely allied to the Musk Ox, *Ovibos moschatus*, Blainv.; and probably, like the latter, the species were clothed in a long fleece, and inhabited the great valley of the Mississippi, just anterior to the drift period. The genus occupies a position intermediate to *Bos* and *Ovis*.

BOOTHERIUM CAVIFRONS, LEIDY.

Bos Pallasii, DE KAY: An. Lyc. Nat. Hist. of New York, Vol. II. p. 280, Pl. VI.; New York Fauna, Pt. I., Zool. p. 110; COOPER: Amer. Month. Journ. of Geology, Vol. I. p. 173; HARLAN: Med. and Phys. Researches, p. 276; Edinb. New Phil. Journ. XVII. 359; H. v. MEYER: Nov. Act. Acad. Nat. Cur. XVII. 1835, p. 155; GIEBEL: Fauna d. Vorwelt, I. p. 154.

Bos bombifrons: Proc. Am. Assoc. Cincinnati, 1851, pp. 179, 235.

Bootherium cavifrons, LEIDY: Proc. Acad. Nat. Sci. Vol. VI. p. 71.

Through the kind recommendations of several friends, Professors Baird and Agassiz, and Mr. W. S. Vaux, Mr. Thomas Kite, of Cincinnati, Ohio, brought with him to Philadelphia for my inspection, in the spring of 1852, an excellent specimen of the cranium proper of an extinct species of ox, to which I have given

the above name. It is well preserved, compact, heavy, and brown in color from the infiltration of oxide of iron (Plate III., Figs. 1, 2; Plate IV., Fig. 1). Mr. Kite discovered the specimen in the hut of an Indian, in which it was used as a seat, and he was informed it was found in a neighboring gravelly bluff, near Fort Gibson, on the Arkansas River.

Compared to the cranium proper of the American Buffalo, it is relatively higher and narrower. The inion is also relatively higher and narrower (Plate III., Fig. 2).

The bases of the horn-cores, instead of being placed on a line with the orbits posteriorly, as in the Bison and Domestic Ox, are elevated above them, as in the Musk Ox. They are also united together on the top of the head, forming a very remarkable process, covering the os frontis like a huge exostosis (Plate III., Fig. 1). This process extends from within ten lines of the inion the entire length of the os frontis, or four inches anterior to the bases of the horn-cores, and two inches posterior to them. Its length is ten and a half inches, and between the horn-cores it is five and a half inches wide, and anterior to them five inches. At its posterior extremity (Fig. 2), it is one and three-quarter inches thick, and at its anterior border about half an inch. The whole process is remarkably rough and tuberculated, and presents, in some degree, the appearance of an exostosis, the result of disease. Its upper surface is depressed into a concavity, deepest between the horn-cores and divided at bottom by a prominent median ridge. Laterally, the frontal process is continuous with an elevated rough ridge curving in a sigmoid manner beneath the base of the horn-cores. About the middle of its course this ridge comes in contact with the post-orbital ridge proceeding backwards from the post-orbital arch.

The horn-cores project outwards, downwards, and forwards. They are demiconoidal; being flattened on their antero-superior surface the whole length, but in a most marked degree at the basal and distal third. The latter portion of the horn-core has a slight twist directing the flat surface more upwards. The under or convex surface of the horn-cores is marked by deep vascular grooves, and others corresponding to ridges of the inner parietes of the horns. The flat surface is relatively smooth except near the tip, where it is also marked, though in a less degree, by grooves corresponding to ridges of the horns.

The inion (Plate III., Fig. 2) is seven and a quarter inches in height from the upper margin of the occipital foramen to the top of the frontal process, or four inches five lines to the parieto-occipital crest. The middle of the latter is constituted by a quadrilateral rough protuberance for the attachment of the ligamentum nuchæ. On each side below the crest is a deep oval muscular impression.

The supra-orbital margin is situated three inches below the line of the highest part of the horn-cores, which commence above the position of the posterior fifth of the orbital entrance. It is notched at its junction with the lachrymal bone. The latter, one and three-quarter inches antero-internal to the notch just mentioned, forms a deep lenticular depression, or larmier, such as exists in the Deer and Sheep (Plate IV., Fig. 1).

The occipital condyles in the specimen appear to have suffered in some degree

from the wearing influence of running water; but they appear originally to have been more uniformly convex than in the Bison, or they have not been so abruptly bent about their middle. The inferior portion also is very much less inclined outwards from a level than in the latter.

The occipital foramen is absolutely a little less in size than in the Bison, and is almost one inch and a half in diameter.

The base of the paramastoids is thick and pyramidal, and between these and the condyles is a broad shallow concave surface not more than three fourths of an inch deep from the level of the lowest part of the condyles, while in a corresponding position in the Bison a fossa exists at least two inches in depth from the same points of measurement.

The basilar process is three and a half inches wide posteriorly, and is strongly marked by the attachment of the anterior cervical muscles. The prominences just in advance of the condyles are one and a half inches wide, and to their outer side, about ten lines in advance of the condyles, is the foramen condyloideum. Just anterior to the latter, and separated from it by a simple transverse ridge, is the jugular foramen, and in advance of this is the os tympanica, not at all inflated, but presenting an irregular crest continuous from the base of the paramastoid inwards and forwards to the side of the basilar process, and there terminating in a short compressed conoidal apophysis. Immediately internal to the latter is the foramen lacerum, and from this the groove is continuous to the inner side of the pterygoid processes, for accommodating the Eustachian tube.

The stylal depression is a cylindrical pit half an inch deep and in diameter.

The auditory process commences in a vaginal apophysis, continuous with the os tympanica, forms the anterior wall of the stylal depression, and has an oblique position outwards, backwards, and upwards. Its anterior surface is concave, and its lower margin presents a groove, passing outwards from the stylal depression, bounded on each side by a ridge, the anterior of which is acute and continuous with the margin of the vaginal process. Between the paramastoids, stylal pit, and auditory process is the stylo-mastoid foramen.

The meatus auditorius externus is longitudinally oval, and is situated about twenty lines above the level of the lowest part of the basilar process.

The glenoid articulation is, in a trifling degree, less convex than in the Bison, is about two and a half inches in breadth, and one and a half antero-posteriorly, and is on a level with the upper part of the meatus auditorius externus.

The post-glenoid tubercle is compressed conoidal, with a slight twist, and is longer than in the Bison.

The glenoid foramen is circular, about two lines in diameter, and occupies a position immediately outside of the post-glenoid tubercle.

The root of the zygoma, at its outer margin, projects considerably external to the position of the base of the horns. Its upper surface above the glenoid articulation presents a large deep concavity, above which, posteriorly, are two large foramina.

The space between the glenoid articulation and the root of the zygoma is much narrower than in the Bison, and the foramen rotundum is less advanced, being on a line with the anterior face of the post-glenoid tubercle.

The process formed by the conjunction of the temporal, sphenoidal, and frontal bones, at the inferior limit of the temporal fossa, is very much larger and more prominent than in the Bison.

The supra-orbital foramen is placed about twenty lines within the supra-orbital margin.

The temporal fossa (Plate IV., Fig. 1), is relatively more superficial than in the Bison, but is more oblique in its course forwards and downwards, and has a greater breadth from the base of the horn-core to the root of the zygoma.

Admeasurements.

From middle line of os frontis to the tip of the horn-core above	16 inches, 6 lines.
Length of posterior curve of horn-core	15 " 6 "
Greatest distance between the bases of the horn-cores above	5 " 6 "
Antero-posterior diameter of base of horn-cores	4 " 6 "
Vertical " " "	3 "
Circumference at base	12 " 6 "
" three inches from the base above	10 "
Greatest breadth of head at the supra-orbital margins	9 " 6 "
From occipital condyle to the lachrymal margin of the orbit	11 "
Height from basilar process to summit of frontal process at the inion	9 "
Breadth at the glenoid articulations	8 " 6 "
Length of temporal fossa	6 " 6 "

The specimen of the cranium of an extinct ox, described by Dr. De Kay, before referred to, without doubt belongs to the *Bootherium cavifrons*. From its mutilated condition, the concavity of the frontal process was suspected as being the result of the removal of the whole of the external plate of the os frontis, and the species was supposed to be the same as that indicated by two heads described by Pallas,¹ and one by Ozeretskovsky.²

One of the specimens of Pallas was discovered on the shores of the Ob, immediately under the arctic circle; the other was found more northerly in the region of Tundra. That described by Ozeretskovsky was obtained at the mouth of the Yana, between the Lena and Indigirska.

In the better specimen of those indicated by Pallas, Cuvier³ says the forehead is flat, and the bases of the horn-cores occupy all the space from the orbits to the occipital crest, and approach on a straight line, leaving not more than a finger's

¹ Nov. Com. Petrop. xvii. p. 601; Nov. Act. Petrop. i. 2, p. 243.

² Mém. de l'Acad. de St. Petersburg (1810), iii. p. 215, tab. 6.

³ Ossem. Fos. ed. 4, t. vi. p. 313.

breadth between them, and adds that it would be difficult to distinguish this cranium from that of the recent Musk Ox.

Of the specimen described by Ozeretskovsky, Cuvier is undecided whether to consider it as belonging to the same species of the latter or not, but a simple inspection of Ozeretskovsky's figures, reproduced in Cuvier (Plate CLXXII., Figs. 6 and 7), proves a very close relationship with the recent Musk Ox, and indicates a very distinct animal from *Bootherium cavifrons*, as represented in the figures of the cranium, in Plates III., IV. of this memoir. At a glance, it will be observed that in the former, the horn-cores approach very near each other along their bases, and turn up at their tips like in the Musk Ox, while in the latter, the horn-cores are widely separated at base, and do not turn up at the tip.

Among a large collection of bones and teeth of the Mastodon from Benton County, Missouri, purchased by the American Philosophical Society, and deposited in the Academy of Natural Sciences, I have observed the cranial portion proper of the head of three individuals of *Bootherium cavifrons*, agreeing in all the details with the specimen just described. With them, also, there are fragments of five horn-cores of the same species.

All these Missouri specimens are much decomposed, being exceedingly friable, white, and chalk-like. They are much mutilated, but all the cranial fragments still possess the remains of the remarkable frontal process, and, in one specimen, this verges close upon theinion, and in that position is two and a half inches in thickness.

In the collection of the Boston Natural History Society, I observed a specimen consisting of the posterior part of the cranium with portions of both horn-cores of *Bootherium cavifrons*, which was discovered in the alluvium of the Kentucky River, a tributary of the Ohio River, in Kentucky, and was deposited with the Society by Mr. J. W. Foster.

Through the kindness of Professor Baird, I have received, for inspection, from Professor Samuel St. John, of Hudson, Ohio, a much water-worn fragment of a cranium with one horn-core attached, of the same species, which was found in Trumbull County, Ohio.

Thus have been indicated portions of the crania, of at least twelve individuals of *Bootherium cavifrons*, all found in the great valley through which flows the Mississippi with its tributaries. And from the number of remains, it is probable that this animal, at a former period, fed in vast flocks upon the rich prairies of the valley and the fertile banks of its streams.

Accompanying the fragments of crania and horn-cores of *Bootherium cavifrons*, from Missouri, above described, were two astragali and a metacarpal bone in the same condition of preservation as the former specimens, and no doubt belonging to the same animal.

The astragali have their surface much disintegrated, and, in their present state, measure about three and a quarter inches in their long diameter, and two inches in their breadth.

The metacarpal bone is also much injured upon the surface.

Its measurements are as follow :—

Length	9 inches, 7 lines.
Breadth at the proximal articulation	3 " 4 "
" distal "	3 " 5 "
Circumference at middle	6 " 3 "

Among the collection of Jefferson from Big-bone Lick, there is a specimen of a right metacarpal in perfect condition, which may also probably belong to *Bootherium cavifrons*, although it is a little larger than that last described. It is not improbable that it might belong to *Bison latifrons*.

Its measurements are as follow :—

Length	10 inches, 3 lines.
Breadth at proximal end	3 " 9 "
" distal "	3 " 7 "
Circumference at middle	6 " 4 "

A metatarsal bone and a first phalanx, in the collection of Jefferson, probably also belong to this species. The former is of the left foot, and is a little shorter and considerably less robust than the corresponding bone from Georgia, attributed to the *Bison latifrons*.

Its measurements are as follow :—

Length	10 inches.
Breadth of proximal articulation	2 " 3 lines.
" distal "	2 " 7 "
Circumference at middle	4 " 9 "

The phalanx measures three and a quarter inches in length.

BOOTHERIUM BOMBIFRONS, LEIDY.

—, WISTAR: TRANS. AMER. PHIL. SOC. N. S. Vol. I. p. 359.

Bos bombifrons, HARLAN: FAUNA AMERICANA, p. 271; MED. AND PHYS. RES. p. 275; EDINB. NEW PHIL. JOURN.

XVII. 359; COOPER, SMITH, AND DE KAY: AMER. JOURN. SCI. XX. 370; COOPER: AM. MONTH. JOURN. OF GEOL. Vol. I. p. 173; DE KAY: AN. LYC. NAT. HIST. II. 286; NEW YORK FAUNA, ZOOLOGICAL Pt. 1, p. 110;

MEYER: N. A. A. NAT. CUR. XVII. p. 143.

Bootherium bombifrons, LEIDY: PROC. ACAD. NAT. SCI. Vol. VI. p. 71.

The only characteristic specimen which I have seen of the *Bootherium bombifrons*, is that first described and figured by Dr. Wistar from the collection of Jefferson. It consists of the cranium proper, with both horn-cores attached, and presents the ordinary condition of preservation of all the preceding bones described from the morasses of Big-bone Lick (Plate IV., Fig. 2; Plate V).

The upper outline of the head of *Bootherium bombifrons*, when viewed laterally (Plate V., Fig. 1), resembles in its posterior rise from the inion and its abrupt declination forward that of the Sheep. The os frontis, instead of forming an exostosis-like process, as in *Bootherium cavifrons*, rises gradually from its commencement anteriorly, and forms a sort of hump, from the sides of which, like

in the last-mentioned species postero-superiorly to the orbits, the horn-cores arise. The highest portion of the os frontis is between the posterior part of the bases of the horn-cores, and in this position is elevated over two inches above the line of the supra-orbital margin. Anteriorly to this most elevated part, the os frontis inclines at an angle of about 45° , but posteriorly has a less degree of inclination. The apex is transverse, obtuse, and impressed at the middle. The parieto-frontal surface is quadrilateral, about four inches square, moderately convex, and presents a broad shallow impression at its central part.

The horn-cores curve outwards, downwards, and slightly forwards. They arise about three and a half inches in a curved line from the inion, or about two and a half in a straight line. They are elongated, conical, curved, and longitudinally furrowed.

The inion (Plate V., Fig. 2) is about four inches in height above the occipital foramen, and in its details corresponds pretty closely with *Bootherium cavifrons*.

The relative position of the orbits to the horn-cores is the same as in the species just mentioned. The supra-orbital margin is about two inches below the highest part of the base of the horn-cores, and these commence anteriorly about the posterior sixth of the entrance of the orbits. At its anterior third, the supra-orbital margin is deeply notched, and the supra-orbital process upon the upper or frontal surface, about an inch and a half from the margin, is pierced by three foramina arranged in an antero-posterior row.

In advance of the orbit, the lachrymal bone is depressed into a remarkably deep fossa, or larmier, which appears to have been hemispherical, but, in the specimen, the lower portion is broken away (Plate IV., Fig. 2). At the orbital margin, below the larmier, a deep, broad, lachrymal groove exists, as in *Bootherium cavifrons*.

The temporal fossa presents nearly the same degree of inclination as in the latter, and also has the same relative degree of shallowness and length and breadth of surface which this has in comparison with that of the Buffalo.

The ridge, which in *Bootherium cavifrons* proceeds from the frontal process laterally, beneath the base of the horn-core, is but very feebly developed in *Bootherium bombifrons*.

The base of the cranium, though much mutilated, is sufficiently well preserved to exhibit the peculiarities which associate it in the same genus with *Bootherium cavifrons*. The foramina and processes have the same relation of position and form. Like in the latter, the occipital condyles appear to have been less bent than in the Buffalo, the paramastoids have been large and robust, and the fossæ between them and the condyles have been superficial also, as in *Bootherium cavifrons*.

The basilar process is broad and strongly marked by processes for muscular attachment.

The form of the os petrosa, auditory process, and relative position of the meatus auditorius are the same as in *Bootherium cavifrons*.

The post-glenoid tubercle is relatively larger than in the latter, and between it and the auditory process is a pit, into which opens a large foramen, piercing the root of the zygoma, from the temporal surface. Both the pit and foramen exist, but are much smaller, in *Bootherium cavifrons*.

Admeasurements.

From middle line of os frontis to tip of horn-core	12 inches, 6 lines.
Length of horn-core	9 "
Distance between the bases of the horn-cores	6 "
Circumference at base of "	8 " 6 "
Greatest breadth of head at the supra-orbital margins	6 " 4 "
From occipital condyle to lachrymal margin of orbit	8 " 6 "
Greatest height from basilar process to summit of os frontis	7 "
Length of temporal fossa	6 "

With the same collection of bones which contained the specimen just described, there is preserved a small metacarpal bone, which I suspect to belong to the same species. It is of the right foot, is an adult specimen, and has the following measurements:—

Length anteriorly	7 inches.
Breadth of proximal articulation	2 " 4 lines.
" distal "	2 " 5 "
Circumference at middle	3 " 11 "

REFERENCES TO THE PLATES.

PLATE I.

Figs. 1, 2. A portion of the cranium and left horn-core of *Bison latifrons*, one-fourth the diameter of nature.

Fig. 1. Upper view of the specimen.

Fig. 2. Posterior view of the specimen.

PLATE II.

Fig. 1. Posterior view of the right horn-core of *Bison antiquus*, one-third the diameter of nature.

Figs. 2—7. Molar teeth of *Bison latifrons*, the size of nature.

Fig. 2. Inner view of the second superior true molar of the left side.

Fig. 3. View of the masticating surface of the same tooth as the last.

Fig. 4. Inner view of the last superior true molar of the left side.

Fig. 5. Outer view of the last inferior true molar of the left side.

Fig. 6. Outer view of a much worn last inferior molar of the left side.

Fig. 7. Masticating surface of the same specimen as the last.

PLATE III.

- Figs. 1, 2. Cranium with both horn-cores of *Bootherium cavifrons*, one-fourth the diameter of nature.
Fig. 1. Superior view of the specimen.
Fig. 2. Posterior view of the specimen.

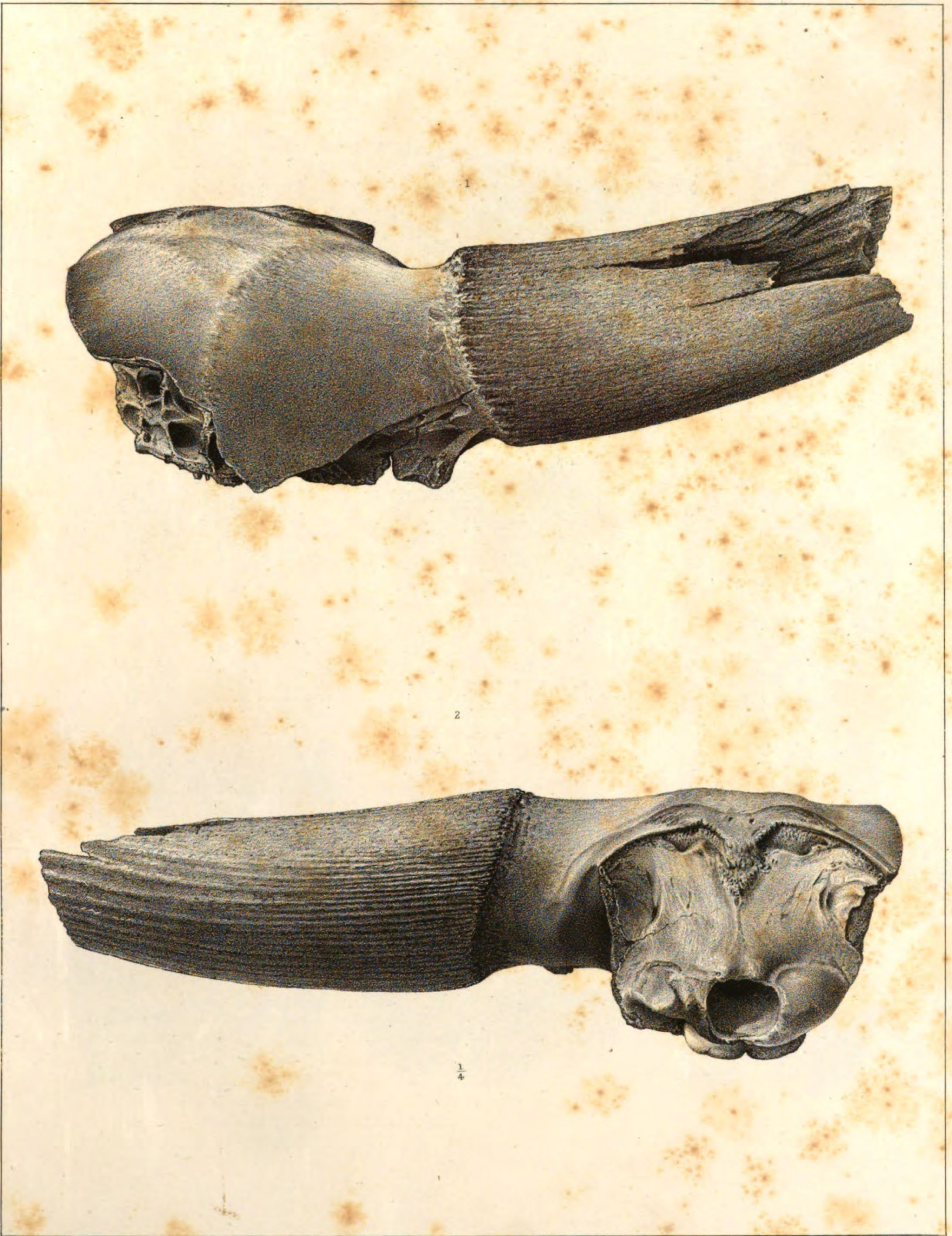
PLATE IV.

- Fig. 1. Lateral view of the same specimen of the cranium of *Bootherium cavifrons*, represented in Plate III., also one-fourth the diameter of nature.
Fig. 2. Upper view of the cranium with both horn-cores of *Bootherium bombifrons*, one-third the diameter of nature.

PLATE V.

- Figs. 1, 2. Views of the same specimen of *Bootherium bombifrons*, represented in Fig. 2, Plate IV., also one-third the diameter of nature.
Fig. 1. Lateral view of the cranium.
Fig. 2. Posterior view of the cranium.

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WASHINGTON, D. C.,
DECEMBER, 1852.



From nature by A. J. Thomson

T. S. Anderson lith. Phil.

BISON LATIFRONS Leidy.

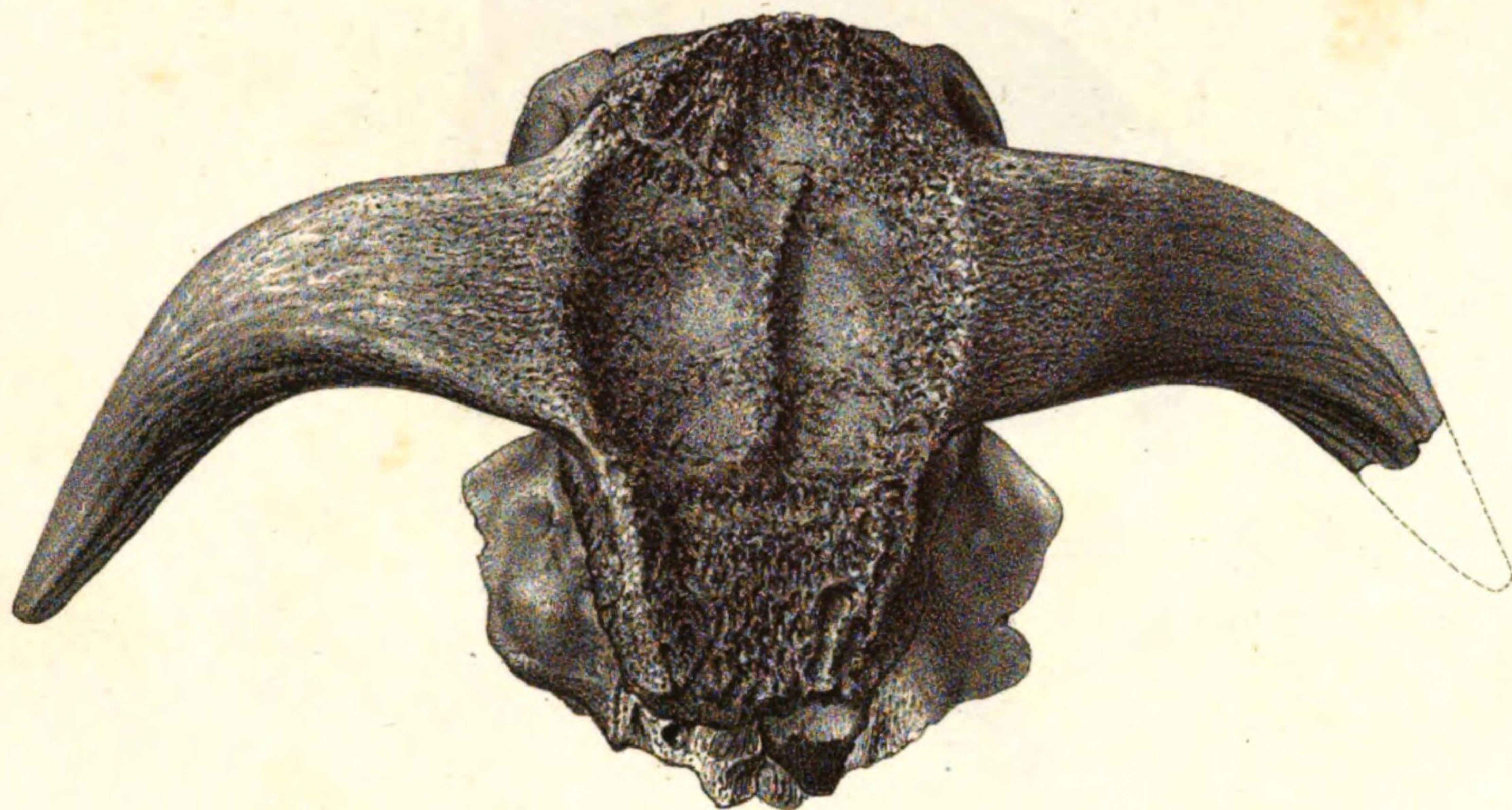


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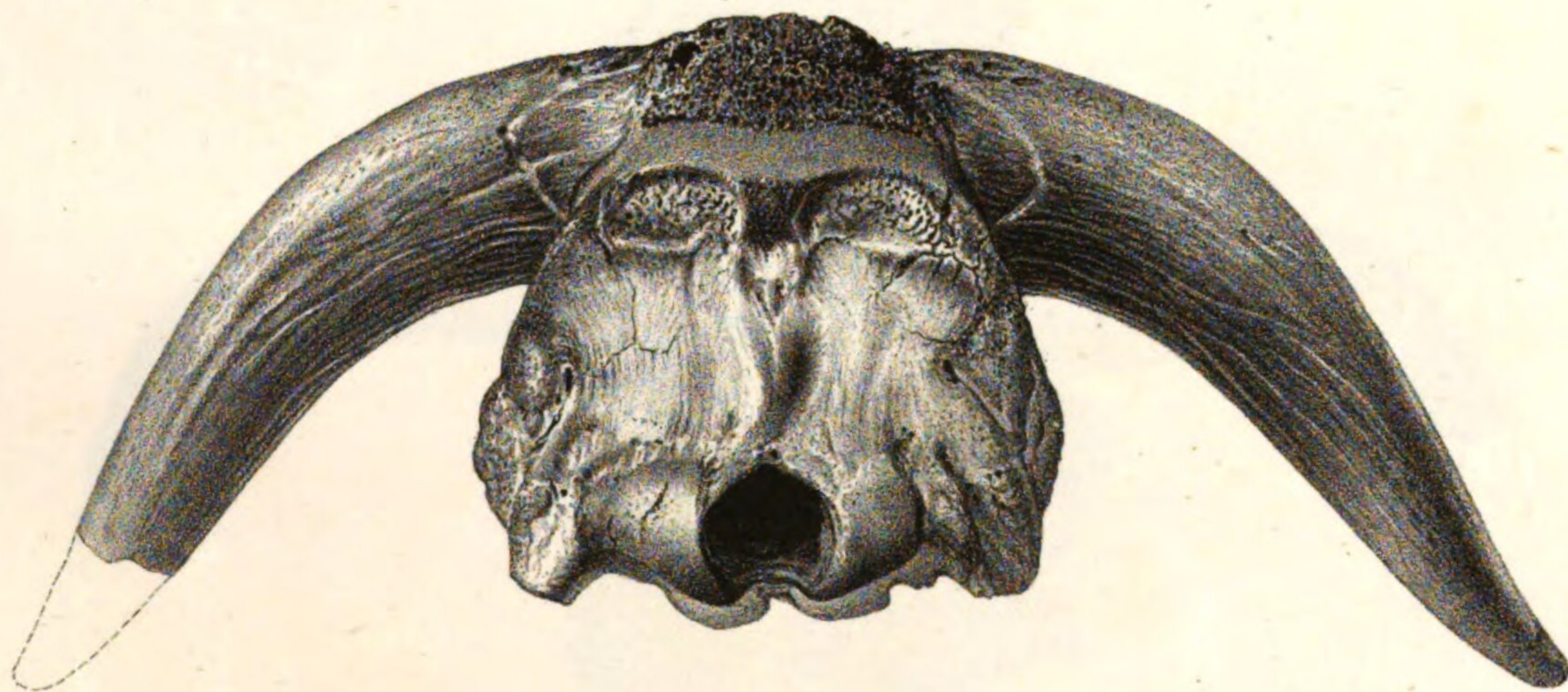
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1. BISON ANTIQUUS. *Leidy*.
2-7. BISON LATIFRONS. *Leidy*.

1



2



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From nature by A. J. Doherty.

T. Sinclair lith. Phil.

BOOTHERIUM CAVIFRONS *Leidy*.

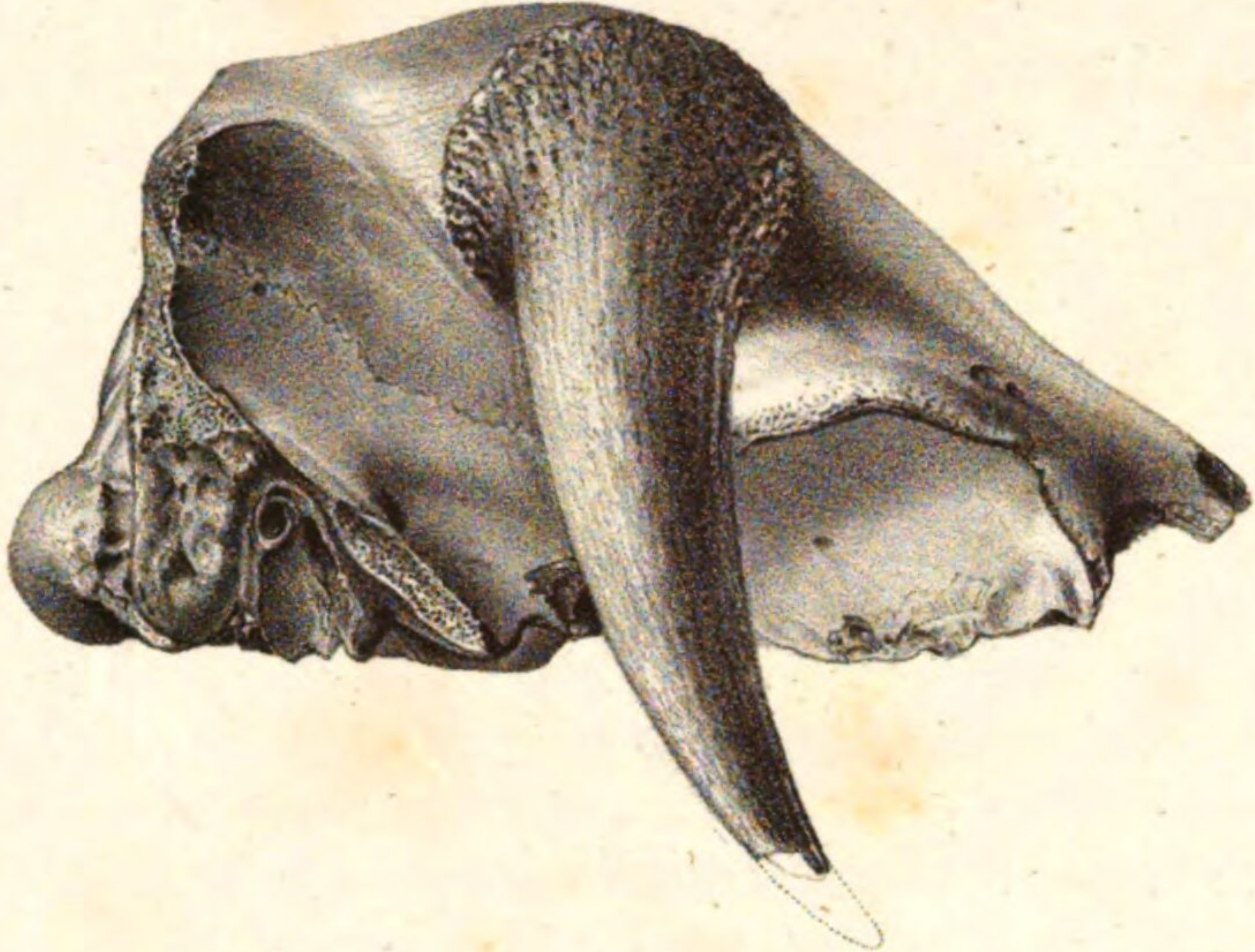


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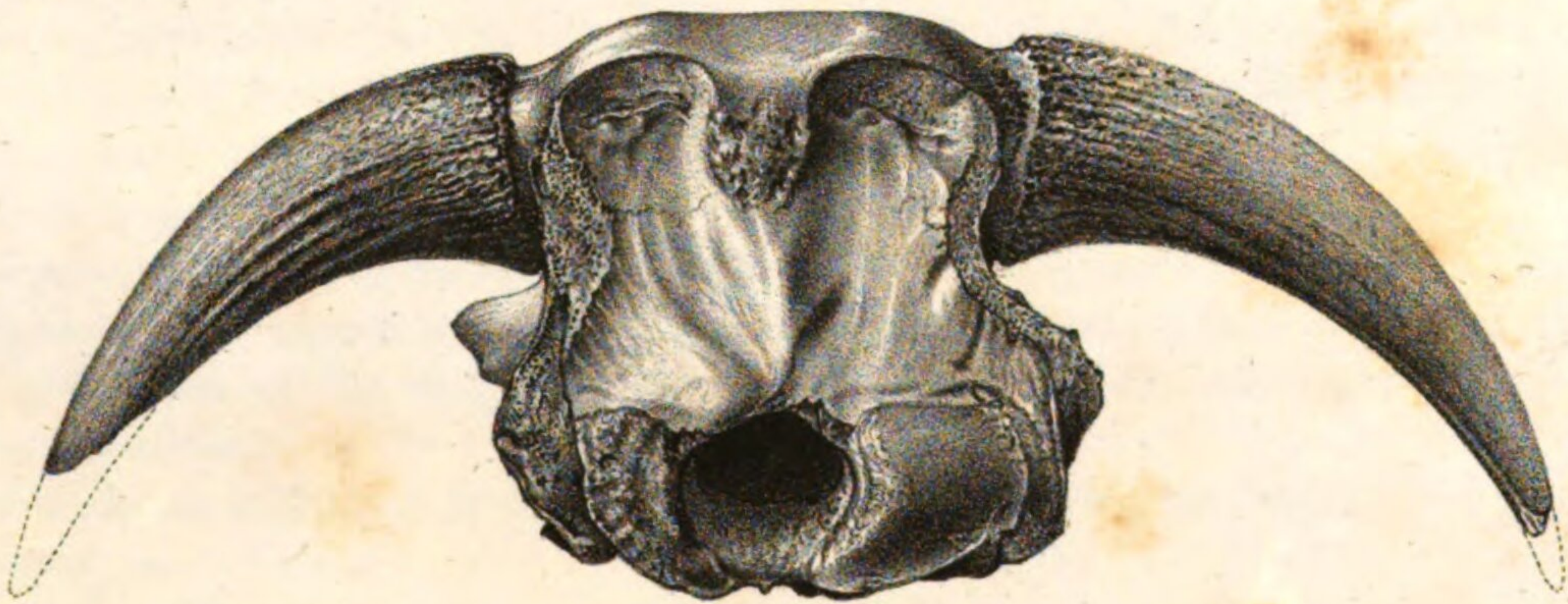
T. Semelroth del. Ph.

BOOTHERIUM CAVIFRONS *Leidy*.
BOOTHERIUM BOMBIFRONS *Leidy*.

1



2



$\frac{1}{5}$

From nature by A. J. Wilson.

T. Sinclair del. Phil.

BOOTHERIUM BOMBIFRONS. *Leidy.*

ARTICLE XXII.

*Description of an extinct species of American Lion: FELIS ATROX. By Joseph Leidy, M. D.
Read May 7, 1852.*

Corresponding in some degree to the relative number in which Carnivora now exist, contrasted with Ungulata, remains of extinct species of the former are rare in their occurrence compared with the abundance in which similar remains of the latter are found.

Until recently no extinct representative of the genus *Felis* had been discovered in North America, but the especial subject of this communication indicates the former existence of a species which much surpassed in size the recent Tiger and Lion, or the extinct *Felis spelæa* of Europe.

The species is established upon the left portion of a lower jaw containing the three molars almost perfect, and the canine much broken (Pl. 34.) The osseous portion of the jaw is very friable, and has a thick envelope of compact peroxide of iron, from which the teeth protrude. Internal to the molars a layer of the latter substance stands up and is impressed upon its other face by a broad bone, which had been in contact.

The specimen belongs to this society, and when first observed was in company with several fragments of bones and a few teeth of other extinct mammalia, without labels, but from the condition of their preservation corresponding closely to that of some specimens, in several instances of the same animals, contained in the collection of the Academy of Natural Sciences, from ravines in the neighbourhood of Natchez, Mississippi, I have no doubt they were derived from the same locality, and probably constitute the donation entered upon the minutes of the Society, April 1st, 1836, of some fossil remains from the vicinity of Natchez, presented by William Henry Huntington, Esq.

Most of the mammalian remains found at Natchez are impregnated with oxide of iron, or are very friable, and enveloped in thick layers of this material very compact in character, or frequently in the case of the teeth have large nodules of the same substance attached, usually to the extremities.

The specimens in the collection of Mr. Huntington, accompanying the fragment of lower jaw, are as follow:—

1. A fragment of the lower jaw of the Mastodon.
2. Two isolated upper molars and an inferior last molar of a large species of Bison.
3. An upper and a lower molar of *Equus Americanus*, *Leidy*. The latter, with some small fragments of the lower jaw, adhere to a thick layer of oxide of iron impressed with the marks of three other molars.
4. Several fragments of bones more or less enveloped in oxide of iron, and not characteristic.

The collection of remains obtained by Dr. Dickeson at Natchez, preserved in the cabinet of the Academy, belong to the genera *Megalonyx*, *Mylodon*, *Bison*, *Cervus*, *Equus*, *Mastodon*, and *Ursus*.

From the associated remains found in this locality, the extinct species of *Felis*, indicated by the portion of lower jaw, which I propose to designate as the American Lion or *Felis atrox*, was cotemporary with the *Mastodon*, *Megalonyx*, *Mylodon*, *Bison*, *Cervus*, *Equus*, and *Ursus*.

The exact outline of the jaw in the specimen is difficult to ascertain, from its thick ferruginous coating, but from several exposed points of the body along its base it appears to have been a little convex downwards, as is frequently the case in the Lion. The symphysis rises in the gradual convex manner more usual in the latter than in the Tiger. The hiatus anterior to the molars is long, in correspondence with the size of the animal, but as in the Lion it rises relatively higher in its advance to the canine alveolus than is commonly the case in the Tiger.

No remains of the incisors exist in the fossil. The canine tooth is much mutilated; the summit and back part of the crown, and a layer from the fang being broken away. It appears originally to have been about six inches in length at its anterior convexity, and about fifteen lines in its antero-posterior diameter, and ten in its transverse diameter, at the enamel border of the crown. Its form also appears to have been closely what it is in the recent Lion and Tiger. Upon the inner side of the crown a portion of the characteristic longitudinal ridge exists, which is more prominent at its expanded base than in the animals last mentioned.

The crowns of the molars externally at their base are not so prominent as in the Lion, Tiger, and *Felis spelæa*, and appear in consequence more vertical and less convex.

The form of the carnassial tooth is very nearly the same as in all species of *Felis*. The obliquity of the cutting edges and the fissure separating them correspond pretty closely to the Tiger. The posterior lobe is one-fifth greater in its antero-posterior diameter than the anterior lobe, and it is strongly and evenly convex postero-externally. The point of the anterior lobe does not rise so abruptly or prominently as in the Tiger, or *Felis spelæa*, as represented in Cuvier's figure 7, plate 194, of the 4th edition of the *Ossements Fossiles*, and its base externally presents a slight salient line or ridge.

The second molar tooth is relatively much greater in its antero-posterior diameter contrasted with its length, than in the Lion, Tiger, or *Felis spelæa*. The middle lobe of the crown is compressed conoidal, with a salient edge, and measures $6\frac{3}{4}$ lines at its base externally between the depressions separating it from the anterior and posterior tubercles.

The anterior tubercle is very much broader than in *Felis spelæa*, and resembles more in its form that of the Tiger; its salient edge being antero-posteriorly convex. The posterior tubercle rises very slightly higher than the anterior, and its antero-posteriorly convex margin descends to the outer side of the posterior heel of the tooth. The base of the crown presents a slight crescentic, roughened, salient line or ridge antero- and postero-externally.

The first molar also, as in the case of the tooth last described, is relatively greater in the antero-posterior diameter of the crown, compared with the length, than in the Tiger. The middle conoidal lobe slopes off gradually antero-externally to the base of the anterior prominent convexity of the crown, and its trenchant margin descends in a crescentic line forwards and inwards. The posterior tubercle is large and distinct, and its bottom postero-externally presents a quite salient basal ridge.

Admeasurements of the fragment of lower jaw of Felis atrox, in comparison with F. leo, F. tigris, and F. spelæa.

	F. leo.*	F. tigris.†	F. spelæa.‡	F. atrox.
Depth of lower jaw below the carnassial tooth,	20	20	20	27 lines.
Depth below the first molar,	20	20	18	26 "
Length from the posterior part of the carnassial tooth to the front of the canine,	55	58	55§	77 "
Length of the molar series,	33	32½	38	41 "
Extent of hiatus anterior to the molars,	13	14	13	20 "
Antero-posterior diameter of first molar,	8¾	8½	8½	10 "
do do second do	12	12	13	15 "
do do third do	12	13½	14	15 "

* Measurements taken from a Lioness.

† Measurements taken from a very large specimen, from India, preserved in the Cabinet of the Academy of Natural Sciences.

‡ Cuvier: Ossemens Fossiles, ed. 4, t. 7, p. 452.

§ Ibid. Pl. 194, Fig. 7.

REFERENCES TO PLATE 34.

Figures the size of nature.

Fig. 1 represents the left side of the lower jaw of *Felis atrox*; the osseous portion entirely concealed by a thick envelope of oxide of iron, from which the teeth protrude.

Fig. 2.—Outer view of the canine tooth, removed from its socket.

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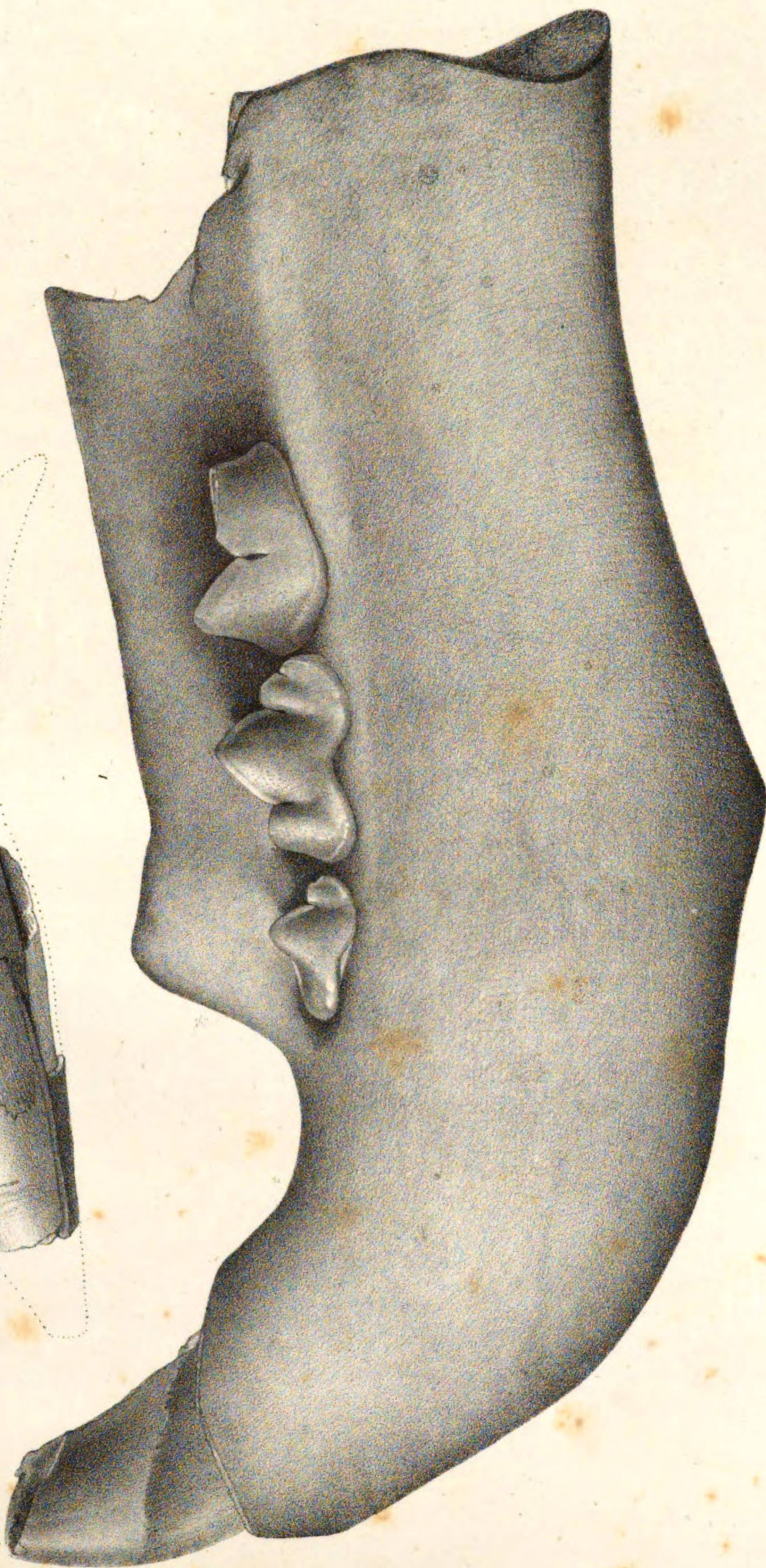
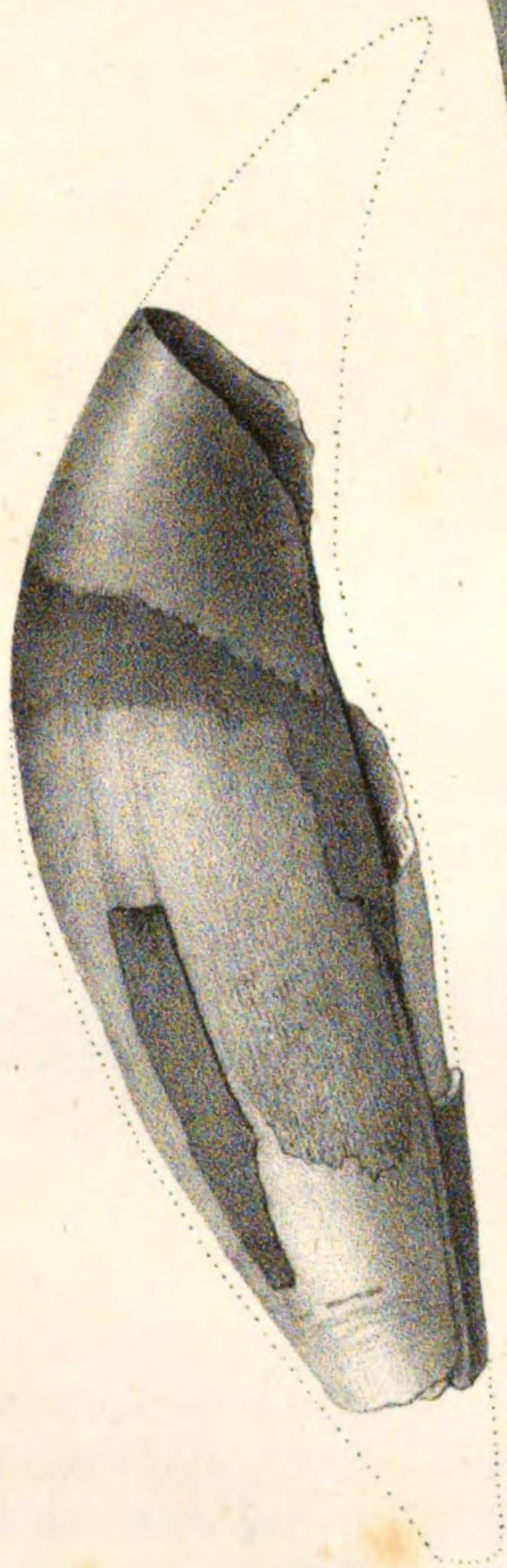
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Trans. Am. Phil. Soc. 2^d Series, Vol. 10, Pl. 31.

2



Felis atrax, Leidy.

ARTICLE XXIII.

A Memoir on the extinct Dicotylinæ of America. By Joseph Leidy, M. D. Read May 21, 1852.

The genus *Dicotyles*, so far as our knowledge extends, appears always to have replaced the genus *Sus* upon the American continent.

The two existing species of *Dicotyles* inhabit all the tropical parts of America, and even extend into Texas. The larger is the *D. labiatus*, the other the *D. torquatus*.

I have not been able to find any authority who gives the distinct osteological characters of the head of the two species except Dr. Rengger in his *Naturgeschichte der Säugethiere von Paraguay*, p. 329.

De Blainville in his *Osteographie*, Article *Sus*, has given three views, in Plate V., of the skull of *D. labiatus*, which he has named *D. torquatus*, although he has represented an undoubted entire skeleton of the latter in Plate III.

The differences observed between a specimen of the head of *D. labiatus* and five specimens of the head of *D. torquatus*, preserved in the collection of the Academy of Natural Sciences, are as follow:

The narrow portion of the cranium, produced by the approach above of the temporal fossæ, is not only relatively but absolutely longer in *D. torquatus* than in *D. labiatus*.

The lower portion of the face is relatively broader in the latter, produced by a prominence commencing on the inner side of the infra-orbital foramen advancing and gradually increasing to the canine alveolus. The prominence slopes outwards from its upper part to its lower margin where it ceases abruptly, and overhangs the anterior premolar alveoli and the edge of the hiatus in advance of the latter, so as to conceal them in viewing the skull from above. It encroaches on the transverse diameter of the infra-orbital foramen, and thus gives it a semi-oval form. It is hollow, and accommodates a large portion of the inferior scroll of the turbinated bone. In *D. torquatus* the prominence does not exist, and its position is occupied by a concavity proceeding from the infra-orbital foramen, which in this species is oval. Moreover, the latter foramen in *D. torquatus* is above the third premolar, while in the other species it is above the first true molar.

The upper part of the face is broad, and relatively moderately convex, in *D. labiatus*, but narrow and strongly arched in *D. torquatus*. In the direction of the length of the ossa nasi in the latter it is slightly convex, but in the former in the same direction slightly concave.

The anterior free extremity of the nasal bones in *D. labiatus* is relatively long and sub-acute; short and convex in *D. torquatus*.

The external face of the malar bone below the orbit in the latter species is more depressed than in the other, and its infero-external margin forms an acute ridge, continuous upon the superior maxillary bone, shelving outwards from above, advancing obliquely over the infra-orbital foramen, and disappearing in a slight prominence in a position corresponding to the bottom of the canine alveolus. The face, below this ridge to the alveolar margin, is concave. In *D. labiatus* the ridge of the maxillary bone, corresponding to the inferior margin of the malar bone, curves much more upwards than in *D. torquatus*, and ceases a very considerable distance posterior to its termination in the latter species. Beneath and within this ridge, the face is more deeply and vertically depressed than in *D. torquatus*.

The face, just in advance of the orbits, is less nearly vertical in the latter than in *D. labiatus*.

In the lower jaw the most striking difference between the two species is the strong bend inwards of the angle in *D. torquatus*, and its nearly vertical condition in *D. labiatus*.

Remains of extinct species of *Dicotylinae* are frequent upon the American continent.

Lund first announced the existence of such remains in the *Danske videnskab. Selskabs naturvid. Afhandl.* volumes 8 and 9, for 1841-2. He observes they are often found in numerous caves of Brazil, and in the tables accompanying his memoirs enumerates five extinct species of *Dicotyles*, but does not describe the specimens upon which they are established.

In Bronn's *Index Palæontologicus*, part first, p. 422, is given the name *Dicotyles major*, *Lund*, as described by Clausen in the *Neues Jahrbuch für Mineralogie*, etc., 1843, but to this work I have not had access.

In the *American Journal of Science* for 1848,* Dr. J. L. Le Conte published an account of a collection of mammalian remains found in the lead region of Illinois. Most of the remains are referrible to *Dicotylinae*, of which the author proposed three new species and genera: *Platygonus compressus*, *Hyops depressifrons*, and *Protochærus prismaticus*. The former of these Dr. Le Conte afterwards described in detail in the *Memoirs of the American Academy of Science and Arts* for 1848.†

Subsequently, in the *Proceedings of the Academy of Natural Sciences* for 1852,‡ the fragments upon which was proposed *Hyops depressifrons* were referred to the genus *Dicotyles*, and a few additional remarks given upon *Protochærus prismaticus*.§

* New series, vol. v. p. 102: Notice of five new species of Fossil Mammalia from Illinois.

† New series, vol. iii., p. 257: On *Platygonus compressus*: a new fossil Pachyderm.

‡ Vol. vi. p. 3.

§ Ibid. p. 5.

In the same work* Dr. Le Conte notices a fossil *Dicotyles* from Benton county, Missouri, found in association with bones of the Mastodon, for which the name *Dicotyles costatus* is proposed.

My friend Le Conte, with his usual liberality, has presented to the Academy of Natural Sciences the specimens upon which the species and genera just mentioned have been founded. Of these, I propose to examine in the succeeding pages only the more characteristic; not only for the purpose of determining as far as possible the distinct species and genera they indicate, which alone is a subject of greater importance to Palæontology than the unrid- dling to which animal every fragment belongs, but more particularly for the sake of com- parison with an almost perfect head of an extinct animal, found in a saltpetre cave in Ken- tucky, belonging to the American Philosophical Society, and deposited by this body, in its desire to advance the interests of Science, in the Cabinet of the Academy of Natural Sci- ences.

The specimens of Dr. Le Conte's collection are very imperfect, brittle, and mutilated, and their investigation has by no means proved an easy one, nor have the results turned out so satisfactory as are desirable.

The most characteristic fossil, for which the name *Platygonus* without doubt must be retained, is the fragment of lower jaw presenting the peculiarity from which the animal derives its name.

The specimen consists of the hinder portion of the right half of the lower jaw of a mid- dle-aged adult. It is much broken, and contains the two posterior molars, also broken, and fragments of the two in advance, (Pl. 38, Fig. 3.) Accompanying the specimen, and apparently belonging to the same individual, are the crowns of the posterior two true mo- lars and premolars of the left side, and the last true molar and the inner lobes of the second, and the three premolars of the right side, of the upper jaw.

The fragment of lower jaw, (Pl. 38, Fig. 3,) is relatively deeper than in *Dicotyles*, and the angle is not only directed more downwards but it curves very much outwards. (Pl. 37, Fig. 9.) The condyle, broken at its inner side, has its articular surface a little more convex than in *Dicotyles*, and externally is not so prominent, and exhibits a small depres- sion for the attachment of the external lateral ligament. The coronoid process is broken away. The fossa posterior to the latter process has the same form as in *Dicotyles*, but is relatively deeper.

The two teeth preserved in the specimen (Pl. 37, fig. 10,) are considerably worn, the dentine being exposed in lobate patches upon all the dental lobes, except the posterior and the internal of the middle pair of the last molar. These teeth are intermediate in size to those of the two existing species of *Dicotyles*, and are constructed on the same type, but their triturating surfaces have none of the wrinkled appearance existing in *Di- cotyles* and reaching its excess in *Sus*, and the principal lobes are more prominently de- veloped and relatively much longer, and the lesser or accessory lobes of *Dicotyles* disap- pear or exist only as continuous portions of the principal lobes. From trituration the principal lobes of the teeth in the fossil have become combined into transverse pyramidal

* Vol. vi. p. 5.

ridges, separated by deep angular transverse valleys, causing the teeth to assume a remarkably taperoid appearance, and indicating a movement in the lower jaw of *Platygonus*, less rotary and more simply ginglymoid than exists in *Dicotyles*; for at the same stage of trituration of the teeth in the latter, the principal lobes would be worn down to a level with the bottom of the interlobular fissures, approaching more in this respect the Hog than the Tapir. In the last molar, the fifth or posterior lobe, broken in the specimen, is simple, and demiconoidal or flattened before and convex behind. Between it and the internal of the second pair of lobes, is a slight tubercle, a constituent portion of the basal ridge.

In neither teeth of the specimen do constituent portions of the basal ridge exist internally between the lobes, but externally, portions unite the bases of the latter.

The upper true molars (Pl. 37, fig. 13,) present the same striking peculiarities which distinguish them from *Dicotyles*, as the lower ones; that is to say, the principal lobes are very robust and prominent, the accessory lobes have disappeared, and the former and the basal ridge are unwrinkled.

These teeth are quadrate, constricted at the middle laterally, have convex sides, and are surrounded by a basal ridge open at the bases internally of the inner lobes. The latter are trilobate as in *Hippopotamus*, or expand before and behind, where they come in contact with the outer lobes, which are simply conoidal. In the specimens, the expansions just mentioned are worn away, leaving the transverse pairs of principal lobes associated as prominent pyramidal ridges, separated by deep and wide transverse valleys, as in the case of the corresponding teeth of the lower jaw.

The basal ridge is best developed anteriorly and posteriorly, and though worn smooth to some degree, yet appears never to have been so wrinkled or tuberculated and foveated as in the Peccary. In the last molar posteriorly, it is prominently convex, and at the middle rises in a simple short accessory tubercle associated with the postero-internal lobe.

The second and third premolars (Pl. 37, fig. 12,) are like one half of the true molars. They are quadrate, with rounded sides and angles, and narrowest and most convex internally, and have a single transverse pair of lobes like those of the true molars, surrounded by a cingulum open for a short space internally and externally at the bases of the corresponding lobes. The cingulum or basal ridge is nearly twice as thick posteriorly as anteriorly.

The crown of the first premolar (Pl. 37, fig. 12,) is trilateral, with rounded angles, and the apex forwards, and consists of a single conical lobe, surrounded at its inner four-fifths by a strong basal ridge best developed posteriorly.

Found in the same crevice with the specimens just described, was a fragment of the face of a young animal containing upon the left side the three permanent premolars, which had not yet protruded, the fangs of the canines, and a single lateral incisor. (Pl. 38, fig. 2.) This specimen Dr. Le Conte referred to *Platygonus compressus* in his memoir on the latter, but subsequently, from comparison with the cave head alluded to, was led to suspect it belonged to *Dicotyles depressifrons*.* From more prolonged compa-

* Pr. Acad. Nat. Sci., vi. 57.

ri-son, however, I am inclined to believe Dr. Le Conte was right in referring it to *Platygonus compressus*, for the form of the fragment of face is very different from the corresponding portion of that specimen upon which *Dicotyles depressifrons* was characterized. And further, the premolars contained in the fragment (Pl. 37, fig. 11,) have the same form and size as those just described, (Pl. 37, fig. 12,) which with very little doubt belonged to the same individual as the fragment of lower jaw characteristic of *Platygonus*. In both, the first premolar possesses but a single conical lobe, which is a very different condition of the tooth as it exists in *Dicotyles*, or the cave head hereafter to be described.

The fragment of a face under consideration, which most probably belongs to *Platygonus compressus*, is constituted by portions of the superior maxillary bones, the right intermaxillary bone and a portion of the right nasal bone. It appears narrower or more compressed laterally than in *Dicotyles torquatus*, arising principally from the absence of the ridge so conspicuous in the latter proceeding from the inferior margin of the malar bone.

The nasal bone is a little less convex transversely than in *Dicotyles torquatus*, but is about as much so longitudinally.

The crescentic ridge of the canine alveolus rises higher relatively than in *Dicotyles*, and in its course forwards runs into the margin of the nares. The intermaxillary bone appears to be unusually long, its upper end being over three inches posterior to the summit of the canine alveolar ridge. Its lateral surface at the upper extremity presents directly outwards, but at the lower half inclines at an angle of about 50°. The upper part of the superior maxillary bone about three inches posterior to the canine alveolar ridge, is protuberant, but presents no indication of possessing the acute ridge proceeding from the malar bone and characteristic of *Dicotyles*. The permanent premolars (Pl. 37, fig. 11,) preserved in the specimen from being unworn, exhibit better their characters in detail than those described. As before mentioned, they have the same size and form of those just alluded to. Their basal ridge is tuberculate and foveate. The principal lobes in the hinder two premolars are confluent at the middle of their basal two-thirds.

The hiatus between the first premolar and the canines, is about one and three quarter inches. The canines have about the same degree of divergence from each other as in *Dicotyles*, but they appear to project a little more forward.

A detached upper canine tooth (Pl. 37, fig. 16,) undoubtedly belonging to the same species, and having the crown perfect and but little worn, exhibits the same form, and about the same degree of lateral compression as in *Dicotyles torquatus*.

The hiatus between the anterior margin of the canine and the lateral incisor is about ten lines.

The latter tooth in the specimen is one of the permanent incisors, and it had not yet entirely protruded. Its crown is but little more than half the size of that of *D. torquatus*, and its form is more simple; being short and slightly compressed mammillary, with the apex impressed by an O shaped disk, with a slightly prominent tubercle in its centre. It is convex both anteriorly and posteriorly; in the latter position, being concave in *Dicotyles*.

In Dr. Le Conte's collection there is a second premolar, (Pl. 37, fig. 14,) and the first and second true molars, (fig. 15,) of the superior left side, which have been referred to *Dicotyles depressifrons*,* but which correspond so closely in size and form with the teeth described of *Platygonus*, that I think they belonged to another and younger individual only of the latter.

ADMEASUREMENTS OF PLATYGONUS.

Fragment of Lower Jaw.

Height from angle to condyle,	-	-	-	-	3 inches 9 lines.
do of body below last molar,	-	-	-	-	1 " 11 "
Ant. post. diameter of last molar,	-	-	-	-	" 10 "
Transverse do do	-	-	-	-	" 5 $\frac{3}{4}$ "
Ant. post. diameter of second true molar,	-	-	-	-	" 7 $\frac{1}{2}$ "
Transverse, do do do	-	-	-	-	" 5 $\frac{1}{2}$ "

Isolated Upper Molars.

Length of premolar series,	-	-	-	-	-	1 inch 2 lines.
Diameter, first premolar,	-	-	-	-	-	Ant. post. 4 $\frac{1}{2}$ lines. Trans. 3 $\frac{3}{4}$ lines.
do second do	-	-	-	-	-	4 $\frac{1}{2}$ " 5 "
do third do	-	-	-	-	-	5 " 5 $\frac{3}{4}$ "
do first true molar,	-	-	-	-	-	6 " 5 $\frac{3}{4}$ "
do second do	-	-	-	-	-	7 $\frac{1}{2}$ " 6 $\frac{3}{4}$ "
do third do	-	-	-	-	-	9 " 7 $\frac{1}{2}$ "

Fragment of Face.

Height of crescentic ridge of canine alveolus,	-	-	-	-	-	1 inch 3 lines.
Distance from summit of the latter ridge to the upper end of the intermaxillary bone,	-	-	-	-	-	3 " 4 "
Narrowest part of face below the upper extremities of the intermaxillaries,	-	-	-	-	-	1 " 2 "
Breadth of each os nasi about middle,	-	-	-	-	-	6 "
Height of face about one inch in advance of the molars,	-	-	-	-	-	2 " 2 "
Length of line of permanent premolars,	-	-	-	-	-	1 " 1 "
Transverse diameter of first premolar,	-	-	-	-	-	4 "
Ant. post. do second do	-	-	-	-	-	4 $\frac{1}{2}$ "
Transverse, do do do	-	-	-	-	-	5 "
Ant. post. do third do	-	-	-	-	-	4 $\frac{3}{4}$ "
Transverse do do do	-	-	-	-	-	5 $\frac{3}{4}$ "

Isolated Superior Canine.

Length of enamelled crown internally,	-	-	-	-	-	1 inch, 7 lines.
Antero-posterior diameter at base,	-	-	-	-	-	6 "
Transverse do do	-	-	-	-	-	3 $\frac{1}{2}$ "

Other fragments, probably belonging to Platygonus compressus, and presented to the Academy by Dr. Le Conte. These are as follow:—

1. Fragments of the forehead, (Mem. Am. Acad. Arts and Sci., vol. 3, plate 2, fig. 4,) indicating the breadth at the post orbital processes to be three and a quarter inches.
2. Several fragments of an os malæ and hard palate.
3. Bodies of a dorsal and lumbar vertebra, (Ib., plate 3, fig. 14; plate 4, figs. 16-18.)
4. Portion of os innominatum.

* Pr. A. N. S., vi. 3.

5. Lower part of both ossa humeri (Ib., plate 4, fig. 21,) of the right side.
6. Bone of fore arm, (Ib., plate 4, fig. 21.)
7. A right metacarpal, without the distal epiphysis, (Ib., figs. 23, 24.)
8. Two astragali: diameter from the bottom of the tibial to the distal trochlea fourteen lines; transverse diameter at middle eight lines.
9. Fragment of an os calcis.

The most important specimen, upon which the genus *Hyops* was proposed, consists of the upper portion of a cranium and face much fractured, (Pl. 38, Fig. 1). The size of the fragment is such as to indicate the existence of an animal a little larger than the *Dicotyles labiatus*, but possessing relatively a little shorter and broader forehead, and a longer and broader, but shallower face. The lateral margins of the forehead and the upper part of theinion are broken away, but it appears as if the length of the former had a little exceeded its breadth. The forehead is also a little more depressed on each side.

The face slopes from the position of the orbito-frontal foramina more abruptly downwards and forwards than in *Dicotyles*, and after two inches of its course rather abruptly ceases to incline so much downwards. That portion of the ossa nasi posteriorly and outside of the groove leading from the orbito-frontal foramina is prominently convex, and on a level with their median line. The fronto-nasal suture forms the outline of a depressed cone with rounded apex, two and a half inches wide at base, and thirteen lines in depth. Anteriorly the ossa nasi are about as convex transversely as in *D. labiatus*.

The orbito-frontal foramina are thirteen lines apart. The upper extremity of the ossa inter-maxillaria, alone preserved in the specimen, inclines at an angle only of about 35° , and the distance of its point from the suture connecting the nasal process of the superior maxillary bone with the os frontis, is two inches one and a half lines. The nasal process of the superior maxillary bone slopes from the ossa nasi laterally at an angle of about 35° .

A prominent acute ridge appears to have existed at the side of the superior maxillary bones, proceeding forwards from the inferior margin of the malar bone in the existing species of *Dicotyles*, and more especially like that in *D. labiatus*, but the specimen is too much mutilated to determine its exact extent and character.

The anterior extremity of the malar bone is broad, not more depressed than in *D. labiatus*, and inclines at about the same angle as the contiguous portion of the superior maxillary bone.

The fractured condition of the specimen permits the extensive sinuses to be seen which every where occupy a position between the tables of the cranial bones, and communicate freely with the ethmoidal and nasal sinuses.

From what has been stated in regard to this fragment, it will have been perceived not to possess a single character which would separate the animal from the genus *Dicotyles*, to which Dr. Le Conte considered it belonging, subsequently* to its being first ascribed to *Hyops*.

* Pr. A. N. S., vi. 3.

Admeasurements of the Fragment of Cranium of Dicotyles depressifrons.

Length of os frontis,	-	-	-	-	-	2 inches, 9 lines.
Estimated length frominion to ossa nasi,	-	-	-	-	4	" 6 "
Distance between orbito-frontal foramina,	-	-	-	-	1	" 1 "
Breadth of ossa nasi at angular processes of os frontis,	-	-	-	-	2	" 2 "
Breadth of ossa nasi at upper end of intermaxillaries,	-	-	-	-	1	" 4½ "
Distance from latter to angular processes of os frontis,	-	-	-	-	2	" 2 "

In company with the fragment of cranium just described as expressive of *Dicotyles depressifrons*, there also was found a fragment of the left side of the lower jaw containing a portion of the corresponding canine tooth, and the distal extremity of a left canine possibly belonging to the same individual as the former.

The specimens indicate a larger species than those recent, and both belonged to an old individual.

The fragment of jaw along the course of the canine alveolus externally is very convex, and just posterior to the symphysis is ten lines thick, and from the base to the edge of the hiatus, a little posterior to the position of the mental foramen, measures fifteen and a half lines. The portion of the fang of the canine remaining in the alveolus at its broken extremity has the dental cavity nearly obliterated. In transverse section the fang of the tooth is quadrilateral, with its longest diameter antero-posterior; anteriorly it is narrowest and convex; externally it presents a projecting longitudinal ridge; posteriorly a longitudinal groove; and internally is convex posteriorly but longitudinally depressed anteriorly.

The distal fragment of tooth presents the same relative proportions and form as the fragment of fang retained in the alveolus. It of course becomes in section trilateral, as in existing species of *Dicotyles*. The end only, of the specimen, which in curve is two and three quarter inches long, has enamel upon it: internally for about one inch, externally for ten lines, and the body of the tooth, with the exception of a remaining portion of the pulp cavity about one-third of a line in diameter, is a solid rod of dentine. The greatest antero-posterior measurement of the fang is eight lines, and that transverse six lines.

Other fragments probably belonging to Dicotyles depressifrons.

Some other specimens presented by Dr. Le Conte to the Academy, which may be considered as belonging to *Dicotyles depressifrons*, are as follow:

1. Distal extremity of both ossa humeri: slightly more robust than in *Platygonus*.
2. Left os femoris, like that of *Dicotyles torquatus*, but larger; its length being seven inches and its circumference at the middle of the shaft two inches and a quarter.

Besides these, there are fragments of the second right metacarpal, left os innominatum, and left tibia, also a scaphoid and cuboid,* and two first phalanges and one second phalanx.

The specimens upon which Dr. Le Conte proposed the *Protochærus prismaticus*† consist of an inferior canine, and a first true and a portion of a last molar of the right side, most

* Mem. Am. Acad. Arts and Sciences, vol. 3, pl. iv. fig. 25, 26.

† Am. Journ. Sci., 2d series, vol. V., p. 105; Proc. Acad. Nat. Sci., vol. VI. p. 5.

probably of that above. They were found under circumstances similar to those already described, but in another locality fifteen miles distant.

The three teeth probably belonged to the same individual, which had passed the middle of adult life, as the specimen of the first true molar, which is about the size of that of the collared Peccary, has its characteristic triturating surface nearly obliterated.

The most characteristic specimen is the fragment of the last molar (Pl. 37, fig. 18), which in outline resembles more the lower than the corresponding upper tooth of the Peccary, but its proper position has been rather determined by comparison with the teeth in the cave head. In the robustness of its lobes it approaches more that of *Platygonus* than that of the Peccary, and from their prominent prismoid character the specific name which has been applied to the animal is quite appropriate. Its admeasurements are as follow:

Estimated antero-posterior diameter, - - - - - 10 lines.

Breadth at middle, - - - - - 6 "

The first true molar measures six lines antero-posteriorly, and four and three quarter lines in breadth.

The inferior canine was rather smaller than that of the cave head, and it evidently belonged to an old individual, as the enamelled portion of the crown is worn away to a length of about sixteen lines, while the remaining portion of the fang, about ten lines long, is somewhat gibbous, and is solid, except a pulp canal in the centre about half a line in diameter. In section the fang is oval, but impressed posteriorly. The external and internal faces of the crown are smooth and convex.

It is not possible at present to determine whether the teeth ascribed to *Protochœrus* do not belong to the same animal characterized from a cranial fragment under the name of *Dicotyles depressifrons*. If they should be proved hereafter to do so, then both the teeth and cranial fragment must fall back into the genus *Hyops*, previously proposed to *Protochœrus*, for the posterior molar tooth described of the latter evidently is generically distinct from that of the recent *Dicotyles*.

Dicotyles costatus was established by Dr. Le Conte from a fragment of the symphysis of the lower jaw in connexion with the right inferior canine tooth. The specimen was found in Benton county, Missouri, in association with bones of the *Mastodon*. The tooth is larger than that of *Dicotyles labiatus*, and the anterior margin of the crown is more acute than in any of the specimens of recent *Dicotyles* which have come under my notice. Its inner side is smooth and convex, and its outer side presents a prominent longitudinal ridge, from which the species is named, but which is sometimes even better developed in the *Dicotyles torquatus*.

The specimen probably indicates a species larger than either of those existing.

Admeasurements.

Greatest breadth at the base of the enamelled crown of the inferior canine, 5½ lines.

Antero-posterior diameter, - - - - - 7 "

On the occasion of the removal of the collection of Mammalian Remains deposited by the American Philosophical Society, in the cabinet of the Academy of Natural Sciences,

I observed an apparently recent skull labelled "Peccary, presented by Dr. Samuel Brown, December, 1805." It struck me as being unusually large, which led me to compare it with the heads of the *Dicotyles torquatus*, and *D. labiatus*, when it proved without doubt to be very distinct from either. But how the head of a third species of existing Peccary should be preserved in the cabinet of our Society for forty-seven years, and the animal be entirely unknown, puzzled me. On examining the minutes of the society for 1805, to find out the locality from whence the specimen was obtained, the mystery was solved. At a meeting of the Philosophical Society, December 20th, 1805, "The bones of the head of a new animal, found in a saltpetre cave, and a specimen of pure native saltpetre, were presented by Dr. Brown of Kentucky." In the course of the same meeting the head was referred to Dr. Wistar for examination, who, at the meeting of January 7th, 1806, reported that the head of what was supposed to be a new animal, presented by Dr. Brown, proved to belong to the Peccary of South America, as described by Daubenton in Buffon's work.

Dr. Harlan refers to this skull in a foot note to page 222 of his *Fauna Americana*, and observes it "certainly belonged to the recent *Peccari*."

The remarkable condition in which the specimen has been preserved no doubt favoured the impression of those who examined it, that it belonged to the recent Peccary. The texture remains entirely unchanged, and it looks as fresh as if prepared but a few years ago, and had become ochreous yellow from being kept out of the influence of light. Within the open fangs of several of the molars I noticed a few small pieces of adhering adipocere. Its state of preservation, however, is not so remarkable as in the case of the bones of the *Megalonyx laqueatus*, *Harlan*, contained in the Cabinet of the Academy of Natural Sciences, and found under similar circumstances: namely, in a cave in Tennessee. These bones not only retain their original texture, but also have attached shreds of fibrous tissue, portions of articular cartilage, and upon one os unguis nearly the entire nail.

With the exception of the greater portion of the ossa nasi, one upper canine, and all the incisors but one inferior lateral, the cave head under consideration is almost perfect, (Pl. 35, 36.)

The animal to which it belonged had not yet reached adult age, although many of the sutures of the skull are nearly obliterated. The summits only of the anterior lobes of the last molars of both jaws have just protruded, and the deciduous molars had not been shed. The latter are preserved on the left side of the upper jaw, but all those of the lower jaw, and of the right side above, except one, are lost.

The general form of the cave head is most like that of the recent Peccary, but differs strikingly in the great relative breadth of the forehead and the more abrupt narrowing and greater degree of prolongation of the face.

The upper part of the occiput in the fossil is relatively broader and shorter than in the Peccary, and the lateral margins, instead of being nearly parallel, as in the latter, form with the summit a semicircle. The infero-lateral portions of the occiput on the same plane with the mastoid portions of the ossa tempora present more outwardly or are more bent forwards. The occipital foramen has the same form as in the Peccary, but the superior margin projects more posteriorly. The condyles have the same relation to the foramen, and the para-mastoid processes the same form and direction.

The top of the cranium or forehead, considered as extending from the inion to the root of the nose, is broader at the post-orbital processes than it is long, but in the Peccary the length greatly exceeds the breadth. It is also more convex antero-posteriorly, but much less so transversely, being nearly flat.

The orbito-frontal foramina and the vasculo-neural grooves leading from them to the side of the face, hold the same position as in the Peccary. From the depression of the forehead the orbit appears more elevated than in the latter: the lachrymal tubercle being only eight lines below the level of the forehead in the fossil, while it is one inch below it in *D. torquatus*.

The temporal fossa has the same form as in the latter, but its surface extends more outwardly in the direction of the post-orbital processes. Its length is absolutely not greater than in *D. torquatus*, but it gains in depth and extent by the increased depth of the zygomatic process.

The malar bone is of extraordinary depth, relatively very much more than in the Peccary. Its outer side is not depressed, as in the latter, but is antero-posteriorly convex, and the inferior margin rises much more upwardly. The masseteric surface of origin, instead of being directed downwards, as in the Peccary, presents more outwards, as in the Hippopotamus, and the acute margin bounding it externally ceases at the maxillary suture, while in the Peccary it is continuous with a highly characteristic prominent, acute ridge of the maxillary bone, advancing anterior to the position of the infra-orbital foramen. The maxillary bone in the fossil, immediately in advance of its conjunction with the malar bone, is elevated into a protuberance upon the same level as the outer surface of the malar bone. The latter rises much higher upon the face than in the Peccary, reducing the nasal process of the superior maxillary bone into a relatively narrow strip, and aiding in the elevation of the orbit anteriorly.

The transverse diameter of the orbit is greater than the vertical and its direction obliquely upwards and forwards, but in the Peccary the former is the shorter diameter and its direction downward and forward.

The face, anterior to the temporal fossa, is relatively very long, compared to that of the Peccary. It is also relatively narrower, principally from the absence of the ridge of the maxillary bone continuous with the malar bone in the latter, which also renders it nearly vertical from the edges of the ossa nasi at its anterior two-thirds.

The central part of the sides of the face, over the position of the infra-orbital foramen, is concave, and is most deeply so just anterior to the latter foramen, which is oval in its form and situated above the interval of the third and fourth molars. The alveoli have a more advanced position in the face than in the Peccary, in which the last molar is on a line with the ant-orbital margin, but in the fossil is placed an inch anterior to it.

The upper part of the face, as constituted by the ossa nasi, is for the most part broken away in the fossil. Its posterior part is broad and only a little convex transversely, while its anterior three-fourths, judging from a small remaining fragment, appears to have been as convex as in *D. torquatus*.

The anterior extremity of the face is more pointed than in the Peccary from the ad-

vancement of the intermaxillaries several lines beyond the alveoli of the central incisors, indicating probably a more prolonged upper lip than in the animal just mentioned.

The basilar process, instead of being nearly horizontal and plane, as in the Peccary, ascends obliquely, is carinated inferiorly, and terminates on each side anteriorly in a relatively very large, prominent tuberosity, serving as an abutment for the post sphenoidal body. Just in advance of the condyles it is depressed on each side into a deep pit for muscular insertion. The ossa tympanica have the same form and construction as in the Peccary. The guttural region exhibits some of the most remarkable features of the cave head.

The post-sphenoidal body in the Peccary ascends at a very obtuse angle from the basilar process, but in the fossil ascends vertically from the line of the palate, and curves forward continuous in the latter direction with the ant-sphenoidal body. The surface of the post-sphenoidal body presents directly forward, and is concave on each side; and that of the ant-sphenoidal body is directed downwards, and is deeply concave upon each side of the azygous process. Compared to the Peccary, a relatively very deep and capacious fossa with concave sides exists in the fossil between the posterior nares and the post-sphenoidal body. It is divided antero-posteriorly by the middle prominence of the latter and the azygous process of the ant-sphenoidal body. Its sides are constituted by the anterior portion of the roots of the external pterygoid processes dilated or bulging outwardly, in conjunction with a lateral expansion of the ant-sphenoidal body where it descends to form the internal pterygoid process. The communication below is trilobate; the corresponding position in the Peccary being cordiform.

The ossa palati early unite with the superior maxillary bones as in the Peccary, so that the transverse palate suture is no more visible. In the Peccary the palate bones where they unite rise posteriorly in the form of a deep angular groove to the inferior edge of the nares, but in the fossil their palate plates are transversely concave, and form between the extremities of the internal pterygoid processes a sharp crescentic edge, between which and the inferior margin of the nares is a remarkable cul-de-sac, divided into two unequal portions by a vertical partition on the left side of the median line. The space in which this cul-de-sac is situated is eleven lines high from the palatal to the nasal margin, and the bottom of the sac extends about one-fourth of an inch anterior to the palatal margin.

An enormous cellular dilatation of an oval form apparently protrudes from between the maxillary and palate bones, and extends backwards to the anterior margin of the external pterygoid process. Its interior communicates anteriorly with the cavity of the nose; externally it is convex, and on its inner surface, forming the lateral parietes of the posterior nares, is concave. It is about two inches long, and at the middle about an inch deep, and three-fourths of an inch wide. It appears to be formed by the palate bone, but of this I am not sure, as its sutural connexions are for the most part obliterated. A similar but smaller dilatation exists in *Dicotyles labiatus*, but in the specimen I have under comparison its sutural connexions are also entirely obliterated.

One of the most remarkable characters of the cave head is the excessive cellular dilatation of the bones about the middle of the face. In addition to the larger dilatations just

described, between the posterior nares and temporo-maxillary fossæ, the malar bones are very much dilated and cellular; the cells communicating with the interior of the maxillary bones. The latter also are not only very much dilated in advance of the malar bones, but between these and the palate bones above the alveoli they extend backward in a cellular cavity, closed behind by the os unguis, at least an inch from the last molar tooth.

The foramina at the base of the cranium have the same arrangement and relations as in the Peccary.

The glenoid cavity is a little more antero-posterior in its long diameter than in the latter, and instead of being upon a level at bottom with the os tympanica is removed from it obliquely downwards and forwards for nearly an inch by the unusual prolongation in this direction of the zygoma.

The meatus auditorius externus is placed in the same relative position as in the Peccary, and is the extraordinary distance of two and a half inches from the glenoid articulation.

The hiatus anterior to the molars is relatively longer than in the Peccary. Its margin is rounded, and out of it rises a linear ridge proceeding to the back of the canine alveolus. Above it, the face exhibits an obtuse low ridge proceeding from just below the infra-orbital foramen forward, and expanding the whole length of the crescentic ridge of the canine alveolus, so conspicuous a character in the Peccary. The latter ridge at its upper part turns inwards and forwards to the antero-lateral edge of the nares as formed by the intermaxillaries and expands gradually downwards and vanishes upon the incisive alveoli. The notch included by the canine alveolar ridge for the reception of the crown of the lower canine when the jaws are closed, is about one and a fourth inches high, and as wide at bottom as the hiatus between the canine and lateral incisor.

The infra-orbital canal commences immediately above the last molar alveolus. The supra-palatine foramen, as it should be called, instead of spheno-palatine, because the sphenoid bone does not always enter into its composition, is placed above and to the inside of the former, is bounded above by the large cellular dilatation of the posterior nares, and is continuous upwards and outwards with the fissure between the latter and the superior maxillary and lachrymal bones. The posterior palatine canal commences at the bottom of a vertical fissure passing from the last designated foramen downwards between the vertical plate of the palate bone and the tuberosity produced by the last molar alveolus. Its exit upon the surface of the hard palate is near the middle of the hiatus anterior to the molars, a couple of lines within its margin, and is continuous with a groove advancing to the naso-palatine foramina, as in the Peccary.

The relative position of the molars, canines, and incisors, is the same as in the latter.

The true molars of the recent Peccary (Pl. 37, figs. 1-4,) appear to be constructed on the type of the Hog, whereas in the cave head they partake more of the character of the Hippopotamus. In the former the crowns present two pairs of principal, short, conoidal, wrinkled tubercles, with constituent portions of the basal ridge wrinkled and tuberculate. The last lower molar, as in all Pachyderms, has its additional lobe. In the latter the principal lobes are relatively very long, prismoid, not wrinkled, but constricted at the sides, and opposed to one another as in the Hippopotamus, so that when the summits are worn off,

they present a slight trefoil appearance. The basal ridge, where it exists, is more foveate, less wrinkled, and more prominently tuberculate. Indeed, the true molars of the Peccary have the appearance as if they had been cast of some soft substance, in the same mould as those of the cave head, and had become contracted in bulk and wrinkled in drying.

The three superior true molars (Pl. 37, figs. 5, 6,) of the cave head decrease in size from the last to the first; the external lobes are smaller than the internal, and a broad basal ridge surrounds them, open only at the bases internally of the inner lobes, and external part of the base of the antero-external lobe of the last tooth. In the latter, the posterior pair of lobes is shorter than the anterior, and that postero-external is the shortest lobe of those of any of the teeth.

The external lobes are simply conoidal; the inner ones are shaped like those of Hippopotamus, or expand anteriorly and posteriorly where they come in contact with the former. In the Peccary and Hog, these expansions are more or less isolated, appearing as accessory wrinkled tubercles. In the cave head the posterior expansion or fold of the antero-internal lobe comes in contact at its lower part with the anterior of the postero-internal lobe, and thus divides the transverse interlobular fissure. The anterior fold of the former lobe and the posterior of the latter divide the basal ridge anteriorly and posteriorly, and are confluent with it.

The basal ridge of the superior true molars anteriorly, is thick, delicately folded, and finely denticulate at the free margin. Posteriorly it has nearly the same appearance, except in the last tooth, where it is much thicker, includes two small foveæ with wrinkled sides, and is divided by a fissure into two unequal tuberculoid portions. Externally in the last tooth the ridge is continuous round the base of the postero-external lobe to the posterior part of the lobe anterior, is thick, folded, and crenulate at margin, and between the lobes includes a fovea containing several minute tubercles. On the other two molars externally the basal ridge is thinnest, and between the lobes includes a fovea with wrinkled sides. Internally in all the upper true molars, constituent folded portions of the basal ridge connect the bases of the inner lobes and enclose foveæ with wrinkled sides.

The inferior true molars (Pl. 37, figs. 7, 8,) have a greater antero-posterior diameter than those corresponding above, but are narrower, and their lobes, also in pairs, are more nearly equal and longer. Constituent portions of the basal ridge exist anteriorly, posteriorly, and between the bases of the lobes externally and internally, where it is, however, relatively feebly developed compared with its condition in the upper molars. The teeth also decrease in size from the last to the first. The lobes are elongated, conoidal, those internal sending a fold backward where they come in contact with the external lobes, and the latter sending a like fold forwards. The anterior fold of the postero-external lobe joins the posterior of the antero-internal lobe. The posterior fold of the postero-internal lobe is relatively very slight to the others.

The basal ridge posteriorly rises into a prominent pyramidal tubercle, most so in the last, where it constitutes the fifth lobe, and least in the first true molar. Between this tubercle and the posterior pair of principal lobes in the last molar, a second and smaller compressed tubercle exists. Anteriorly, the basal ridge is nearly horizontal and denticu-

late. Between the lobes externally it forms a small simple tubercle. Internally, in the same position, it is hardly developed, except in the last molar, where it is also a simple tubercle. In the latter tooth posteriorly on each side of the fifth lobe, it is constituted by a simple tubercle.

The superior deciduous molars preserved in the cave head, (Pl. 37, fig. 17,) regularly decrease in size from the permanent true molars to the first of the former. The third and second superior deciduous molars closely resemble the permanent teeth behind, except that the anterior part of the crown of the second is narrower. The first deciduous molar possesses but a single transverse pair of tubercles, and its crown is trilateral.

From the trituration to which the deciduous teeth have been subjected, trefoil-like tracts of dentine are exposed upon the inner lobes, and simple transverse oval ones upon the summits of the outer lobes. Judging from the wearing of these teeth, the relative length of the lobes of the permanent molars, and the depth of their intervening valleys, the movements of the lower jaw in the animal to which the cave head belonged, were rather more restricted ginglymoid in their character than in *Dicotyles*, but perhaps in a less degree than in *Platygonus*.

In the Peccary the superior premolars (Pl. 37, figs. 1, 2,) still present the same general construction as the true molars. The posterior two present very distinctly the four characteristic wrinkled conoidal lobes, but the postero-internal is reduced in size in the third premolar, and is very feebly developed in the second. The crown of the first is trilateral, and still presents four distinct tubercles, but only one is strikingly prominent.

In the cave head, the three superior permanent premolars, (Pl. 37, figs. 5, 6,) present each a transverse pair of permanent lobes like those of the true molars, surrounded by a basal ridge.

The latter anteriorly and posteriorly is very thick and denticulate at the margin. In the posterior two premolars the hinder portion encloses four small irregular foveæ with wrinkled sides, the anterior portion two similar but larger foveæ. In the first premolar the basal ridge forms a cup with wrinkled sides, from the bottom of which project the two characteristic lobes.

The inferior premolars (Pl. 37, figs. 7, 8,) of the cave head resemble those of the *D. torquatus* (Pl. 37, figs. 3, 4,) with the principal lobes much exaggerated. They decrease successively anteriorly, and are much more nearly equilaterally quadrate than in the Peccary. The posterior two premolars of the fossil are more like the second than the third of the Peccary, but are relatively broader. Each has a transverse pair of principal lobes, very long and shaped like those of the true molars, and bounded behind by a very thick basal ridge rising in an antero-posterior prominence at the middle, and enclosing on each side of the latter a large fovea with wrinkled sides. Anteriorly, also, the basal ridge exists, but is feeble, whether contrasted with the posterior portion or that corresponding to it in the *D. torquatus*. The first premolar is square, or relatively very broad contrasted with that of the Peccary, and the basal ridge forms a cup with wrinkled sides, out of the bottom of which rises a transverse pair of short conoidal lobes.

In *Dicotyles* the exerted portion of the upper unworn canine is enveloped in enamel, ceasing by a sinuous margin at its base and deeply notched anteriorly. The inferior

canines, also, when unworn, are enveloped in enamel, even deeply into the alveoli, except on the posterior concave surface, where a long angular notch extends upwards into the enamel covering. As the animal advances in life, a little after adult age the enamel is completely worn off from the posterior face of the latter tooth, and at a later period the enamelled portion of the tooth becomes completely exserted from the alveolus, the permanently growing dentinal portion alone occupying the latter.

In the cave head we have been particularly engaged in examining, the canine teeth do not differ in construction from those of the existing *Dicotyles*, and their form also is very nearly the same. They are a very little larger than those of *D. torquatus*. The superior canine is compressed to about the same degree as in the former, but it is a little narrower, more convex externally, and to a trifling extent less so internally. The lower canine is relatively more exserted than in either existing species of *Dicotyles*, is convex and smooth internally and externally, and exhibits only a slight disposition to the formation of a ridge at the lower part of the enamelled crown externally.

As before stated, the incisors are not preserved in the cave head, except one (Pl. 37, fig. 19) of those inferior and lateral. This is smaller than in *D. torquatus*, is enclosed within the alveolus, and appears as if it would have always remained concealed. Its crown is simply mammillary, very slightly compressed antero-internally.

Having described this interesting specimen in comparison with the two existing species of *Dicotyles*, we have next to ascertain whether it differs from any of those *Dicotylinae* whose former existence has been established by Dr. Le Conte.

From the fragment of lower jaw of *Platygonus compressus* the corresponding portion of the cave head differs in its being relatively less deep, and in its angle not being produced so much downwards, and instead of curving outwards, as is so remarkably the case in *Platygonus*, it is nearly vertical. The post-coronoid depression is also considerably less deep. The posterior two molars are a little larger than those remaining in the specimen of *Platygonus*, and in the last molar a large accessory lobe is introduced between the fifth and middle pair of lobes, no trace of which exists in the latter.

A good deal of similarity exists between the fragment of the face of *Platygonus* and the corresponding portion of the cave head. In both they present about the same degree of lateral compression; the acute ridge of the superior maxillary bone proceeding from the malar bone, as in *Dicotyles*, is absent; the crescentic ridge of the canine alveolus has about the same extent and course; and in the same relative position in advance of the malar bone superiorly the upper maxillary bone is protuberant. But in the cave head the face is relatively longer, while its intermaxillaries are broader and very much shorter, being $2\frac{1}{4}$ inches in length from the lateral notch of the nares, while in *Platygonus* they are one inch longer.

The posterior two premolars have nearly the same form, but the basal ridge is less strong in *Platygonus*, and is not so deeply foveated. The first premolar in the cave head is quadrate, and has two prominent principal lobes like the two posterior premolars, and possesses a strong basal cingulum open for a short space only internally. In *Platygonus*

the first premolar is trilateral, with one principal lobe, and has its basal ridge open externally. The last superior true molar of the cave head is trilateral, with its rounded apex posterior, while in *Platygonus* it is broader, quadrate, has its constituent portions of the basal ridge laterally less developed, and has its postero-external lobe better developed.

Having said enough to prove the cave head is not only specifically but generically distinct from *Platygonus compressus*, we have next to compare it with the specimens referred to *Dicotyles depressifrons*. With this purpose in view, the first thing which strikes us in examining the fragment of skull of the latter is the evident existence of the acute ridge on the side of the superior maxillary bone, proceeding from the inferior margin of the malar bone, as in recent species of *Dicotyles*, but which does not exist in the cave head.

In the fragment of the skull of *Dicotyles depressifrons*, as before stated, the forehead appears to have been longer than broad, as in recent species of the genus, but in the cave head the breadth greatly exceeds the length.

The face is very much broader in *Dicotyles depressifrons* than in the latter, and has probably been shorter, for in the fragment the distance from the upper end of the intermaxillaries to the suture of the nasal process of the superior maxillary bones with the frontal is a little over two inches, while in the cave head from the same points the distance is one and a quarter inches greater.

In *Dicotyles depressifrons* the nasal process of the upper maxillary bone is broader and more rapidly divergent anteriorly than in the cave head. The upper extremity of the intermaxillaries in the former incline 35° , while in the latter it is nearly vertical, and the face behind these bones, still sloping in the *Dicotyles depressifrons* to the margin of the maxillo-malar ridge, is vertical in the cave head until it begins to dilate posteriorly.

Other but more trifling differences exist, but it is evident, from the comparison which has been made, that the cave head, without doubt distinct from *Dicotyles*, also evidently could not have belonged to the same animal characterized by the cranial fragment as *Dicotyles depressifrons*.

The only specimen among those referred to *Protochærus prismaticus* sufficiently characteristic for comparison with the cave head is the fragment of a last upper molar. The first upper true molar of the cave head has about the same size, and if worn down to the same extent would probably have the same appearance as that ascribed to *Protochærus*, which, however, would also be the case with the much worn tooth of *Dicotyles*. The lower canine also of the cave head, if much worn down, would present about the same size and proportions as that of *Protochærus*, and this also would be the case with that of the collared Peccary under the same circumstances.

The last upper molar of the cave head is in a trifling degree broader than that of *Protochærus*, and the postero-external lobe is relatively to the others less developed. The basal ridge in the former posteriorly forms three short tubercles, enclosing as many foveæ, but in the fragment of tooth in the same position forms a prominent lobe, larger than the fifth lobe of the last lower molar of the cave head, and to the antero-external side of this forms another and smaller tubercle, the two enclosing a single fovea.

These characters of comparison which have been presented between the corresponding

last molar tooth of *Protochærus* and the cave head may be variable in the same species; but of this we must remain in doubt until further discovery of more material: and until further evidence can be brought to prove the cave head belonged to *Protochærus* it will be at least of advantage in the way of reference to consider the former as distinct, and I therefore propose for the animal to which it belonged the name of *Euchærus macrops*.

In conclusion, in answer to what may be urged by some naturalists, that the characters given of *Platygonus*, *Protochærus*, and *Euchærus* are not sufficient to rank them as distinct genera from *Dicotyles*, I must add that it will be admitted that the recognised species of the latter present characters in common not possessed by any of the preceding genera, and therefore these should be distinct, and among these new genera differences exist, quite as important as those separating them from *Dicotyles*. Those who acknowledge the distinction between *Machairodus* and *Felis*, *Ovibos* and *Bos*, *Acerotherium* and *Rhinoceros*, etc., will readily admit this reasoning, and with such naturalists who are so precise as to consider *Bison*, *Bubalus*, *Bibos*, etc., distinct from *Bos*, or *Alces*, *Tarandus*, *Cariacus*, *Megaceros*, and *Strongyloceros*, etc., from *Cervus*, the matter is beyond dispute.

Comparative Admeasurements of the head of Dicotyles torquatus, D. labiatus, and Euchærus macrops.

	D. torquatus.	D. labiatus.	E. macrops.
Length of head from occipital condyle to incisive alveoli,	8 in. 3 lines.	9 in. 6 lines.	11 in. 3 lines.
Distance frominion to end of nose, - - - - -	9 "	10 " 3 "	
" " supra-orbit. foramina to end of nose, -	4 " 3 "	4 " 9 "	4 "
Length of os frontis at middle, - - - - -	*		2 " 1 "
Greatest breadth of forehead, - - - - -	3 "	3 " 5 "	4 " 5 "
Breadth at anterior glenoid tubercles, - - - -	4 "	4 " 9 "	4 " 6 "
" infra-orbital foramina, - - - - -	1 " 4 "	1 " 10 "	1 "
Length of face from ant-orbital margin to incisive alveoli,	5 " 4 "	6 " 3 "	8 " 6 "
Breadth at canine alveoli, - - - - -	2 " 6 "	2 " 7 "	2 " 5 "
" lateral incisors, - - - - -	1 " 2 "	1 " 3 "	1 " 4 "
" ossa nasi at ends of intermaxillaries, -			1 " 1 "
Distance between supra-orbital foramina, - - -	1 " 1 "	11 "	1 " 5 "
Height from midway between supra-orbital foramina to level			
of palate, - - - - -	2 " 10 "	3 " 6 "	3 " 6 "
Height between canines, - - - - -	1 " 9 "	1 " 9 "	2 " ? "
Height ofinion, - - - - -	3 " 6 "	3 " 9 "	3 " 7 "
Vertical diameter of orbit, - - - - -	1 " 5 "	1 " 7 "	1 " 4½ "
Transverse " " - - - - -	1 " 2 "	1 " 2½ "	1 " 7 "
Depth of os mala below orbit, - - - - -	10 "	1 " 1 "	1 " 8 "
" " from end of post-orbital process, -	1 " 2 "	1 " 5½ "	2 " 5 "
From meatus audit. ext. to end of post-glenoid tubercle,	2 "	2 " 6 "	3 "
Length of hard palate, - - - - -	5 " 6 "	7 "	7 " 9 "
Breadth between first true molars, - - - -	11 "	11 "	11 "
Length of upper molar series, - - - - -	2 " 9 "	3 "	3 " 1 "
Length of hiatus anterior to molars, - - - -	7 "	1 " 2 "	1 " 10 "
" " " to canines, - - - - -	8 "	10 "	9 "

* From obliteration of some of the sutures, I am not able to give all the measurements.

	D. torquatus.	D. labiatus.	E. macrops.
Length of lower jaw, - - - - -	6 in. 6 lines.	7 in. 9 lines.	8 in. 10 lines.
Height from coronoid to angle, - - - - -	2 " 11 "	3 " 9 "	3 " 6 "
" " condyle " " - - - - -	2 " 9 "	3 " 3 "	3 " 6 "
" of body at first true molar, - - - - -	1 " 4 "	1 " 7 "	1 " 6 "
Length of symphysis, - - - - -	2 " 3 "	2 " 4 "	2 " 10 "
Distance between coronoids, - - - - -	2 "	2 " 2 "	2 "
" " angles, - - - - -	1 " 11 "	3 "	3 " 10 "
Length of lower molar series, - - - - -	2 " 10 "	3 " 2 "	3 " 4 "
" hiatus, anterior to molars, - - - - -	1 "	1 " 4 "	2 " 2 "

Admeasurements of the teeth in Euchærus macrops.

Ant. post. diam. sup. post. molar, - - - - -	9 "
Transverse diam. " " " - - - - -	6½ "
Height of crown " " " - - - - -	6 "
Ant. post. diam. sup. first true molar, - - - - -	6½ "
Transverse " " " " - - - - -	5 "
Ant. post. diam. sup. third premolar, - - - - -	4¾ "
Transverse " " " " - - - - -	5¼ "
Height of crown " " " - - - - -	5 "
Ant. post. diam. sup. first premolar, - - - - -	4½ "
Transverse " " " " - - - - -	4½ "
Height of crown " " " - - - - -	3¾ "
Ant. post. diam. inf. post. molar, - - - - -	10 "
Transverse " " " " - - - - -	5¾ "
Height of crown " " " - - - - -	6¾ "
Ant. post. diam. inf. first true molar, - - - - -	6¾ "
Transverse " " " " - - - - -	4¾ "
Ant. post. diam. inf. third premolar, - - - - -	5 "
Transverse " " " " - - - - -	4¾ "
Height of crown " " " - - - - -	6 "
Ant. post. diam. inf. first premolar, - - - - -	4 "
Transverse " " " " - - - - -	3¾ "
Height of crown " " " - - - - -	3 "
Length of upper canine along convexity, - - - - -	3 "
" " enamelled portion externally, - - - - -	1 " 3 "
" " lower canine along convex margin, - - - - -	3 " 10 "
" " enamelled portion externally, - - - - -	2 " 7 "

The existing and extinct species of Dicotylinæ, so far as investigations have extended, appear to be as follows:—

EXISTING.

DICOTYLES TORQUATUS, *Cuvier*.

DICOTYLES LABIATUS, *Cuvier*.

EXTINCT.

DICOTYLES, 5 sp.? *Lund*: Danske naturw. Afh., 1841-2.

DICOTYLES MAJOR, *Lund*: Clausen, in neues Jahrbuch für Mineralogie, etc., 1843; Bronn, Index Palæontologicus, Abth. 1, s. 422.

DICOTYLES DEPRESSIFRONS, *Le Conte*: Proc. Acad. Nat. Sci., vi. 3.

Probably all the fragments mentioned in the latter communication belong to this animal, except the "four teeth from the upper jaw."

Hyops depressifrons, *Lec.*: Am. Journ. Sci., 2d ser., 5, 104; Proc. A. N. S., vi. 57: "a cranium."

DICOTYLES COSTATUS, *Le Conte*: Pr. A. N. S., vi. 5.

PLATYGONUS COMPRESSUS, *Le Conte*: Am. Jour. Sci., 2d ser., 5, 103; Trans. Am. Acad. Arts and Sci., n. ser., 3, 257. All the specimens represented in the accompanying plates to the latter memoir, I think, belong to this animal.

Hyops depressifrons, *Lec.*: Pr. A. N. S., vi. 57: "fragments of anterior part of head with premolars and canines: the entire dental series of upper jaw."

PROTOCHOERUS PRISMATICUS, *Le Conte*: Am. Jour. Sci., 20. 5, 105; Pr. A. N. S., vi. 5.

Hyops depressifrons, *Le Conte*: Pr. A. N. S., vi. 57: "the canine and two inferior molars of lower jaw."

EUCHÆRUS (Protochœrus?) MACROPS, *Leidy*: hoc op.

REFERENCES TO THE PLATES.—PLATE 35.

Represents a view of the left side of the skull of Euchærus macrops two-thirds the size of nature. In the original, the nasal bones are broken, as indicated, and the right intermaxillary only exists; but the latter has been transferred to the left side, being otherwise the best preserved, principally on account of the teeth. The latter visible in the upper jaw, are the canine, the three temporary molars, and the succeeding permanent true molars, the last of which is just commencing to protrude. In the lower jaw are visible a portion of the third permanent premolar ready to protrude, and the succeeding true molars; the last partially only.

PLATE 36.

Two views, one-half the natural size of the skull of Euchærus macrops.

Fig. 1.—Upper view. The nasal bones in greater part, and the left intermaxillary are broken away, permitting the ossa turbinata, etc. to be seen.

Fig. 2.—View of the base of the skull. The left side of the upper jaw contains the three temporary molars, and the three permanent true molars. The right side, from which the temporary molars were lost, has exposed in their place the permanent premolars.

PLATE 37.

All the figures are of the natural size.

Figs. 1—4.—Molar teeth of the right side of Dicotyles torquatus, represented for comparison.

Fig. 1.—View of the triturating surfaces of the upper molars.

Fig. 2.—Outer view of the upper molars.

Fig. 3.—Triturating surfaces of the lower molars.

Fig. 4.—Outer view of the lower molars.

Figs. 5—8.—Right molar teeth of *Euchærus macrops*. The premolars were still concealed within the jaws, and also the last molar partially, but they have been represented as protruded.

Fig. 5.—Triturating surfaces of the upper molars.

Fig. 6.—Outer view of the upper molars.

Fig. 7.—Triturating surfaces of the lower molars.

Fig. 8.—Outer view of the lower molars.

In Figs. 7, 8, the second premolar has been accidentally reversed from its true position.

Fig. 9.—View of the posterior margin of the right side of the lower jaw of *Platygonus compressus*, exhibiting the extent of curvature of the angle outwardly. Same specimen as fig. 3, pl. 38.

Fig. 10.—The posterior two right inferior molars of *Platygonus compressus* viewed upon the triturating surfaces. From the same specimens as the previous figure and fig. 3, pl. 38.

Fig. 11.—Upper left premolars of *Platygonus compressus* viewed upon the triturating surfaces. The first tooth is broken off at the anterior part. From the same specimen as fig. 2, pl. 38. They are unworn, and had not yet protruded from the jaw.

Figs. 12—15.—Upper molars of *Platygonus compressus*, 12, 13, and 14, 15, from two different individuals; the former very probably belonging to the same individual as figs. 9, 10, and fig. 3, pl. 38.

Fig. 12.—Right upper premolars. The middle tooth in the original has its inner tubercle split to the base, a thin lamina lost from the fissure, and the two portions approached together, so that it appears a little different from that represented by figure 14.

Fig. 13.—Posterior two left upper molars.

Fig. 14.—Middle left upper premolar.

Fig. 15.—First and second left upper true molars.

Fig. 16.—Left canine of *Platygonus compressus*.

Fig. 17.—Temporary molars of the upper left side of *Euchærus macrops*.

Fig. 18.—Right upper last molar, with its anterior part broken off, of *Protochærus prismaticus*.

Fig. 19.—Lower lateral incisor of *Euchærus macrops*.

PLATE 38.

Fig. 1.—Represents the fragment half the natural size upon which is established the *Dicotyles depressifrons*. It exhibits portions of the parietal, frontal, nasal, maxillary, intermaxillary, and malar bones.

Fig. 2.—View of the right side of a portion of the face of the natural size of *Platygonus compressus*. It is the same specimen represented in pls. I., II., of vol. 3, of the *Mem. Am. Acad. Arts and Sci.*, but in this figure the canine alveolus with a portion of the tooth which had been broken off, is reattached. Anterior to the latter, the specimen is obscured by a hard brown mass, apparently consisting of a combination of lime and oxide of iron. Portions of the nasal, intermaxillary, and maxillary bones are seen; and on the left side a portion of the maxillary bone in outline with the three permanent premolars, which had not yet protruded from their alveoli. The latter teeth are represented in figure 11, pl. 37.

Fig. 3.—Portion of the right side of the lower jaw containing the last two molars, the natural size, of an adult individual of *Platygonus compressus*. A fragment of matrix obscures the angle, and another portion is attached in advance of the condyle.

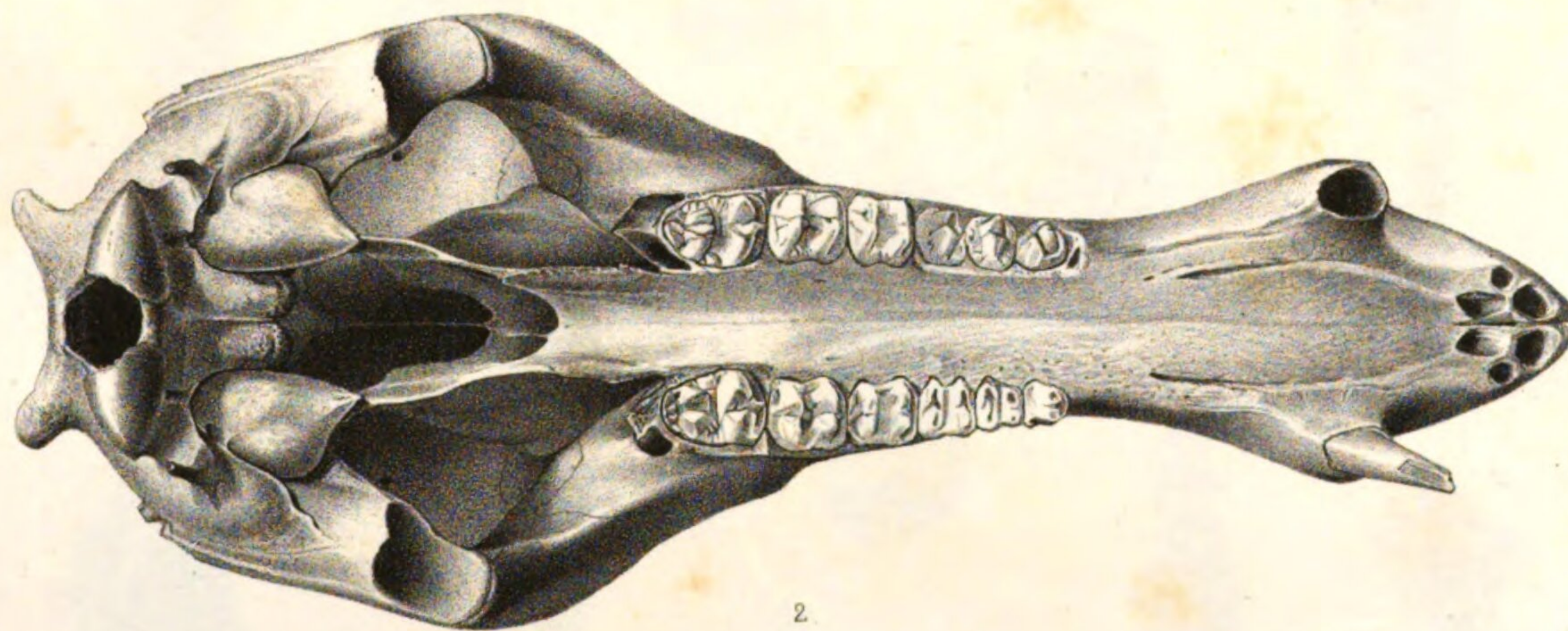
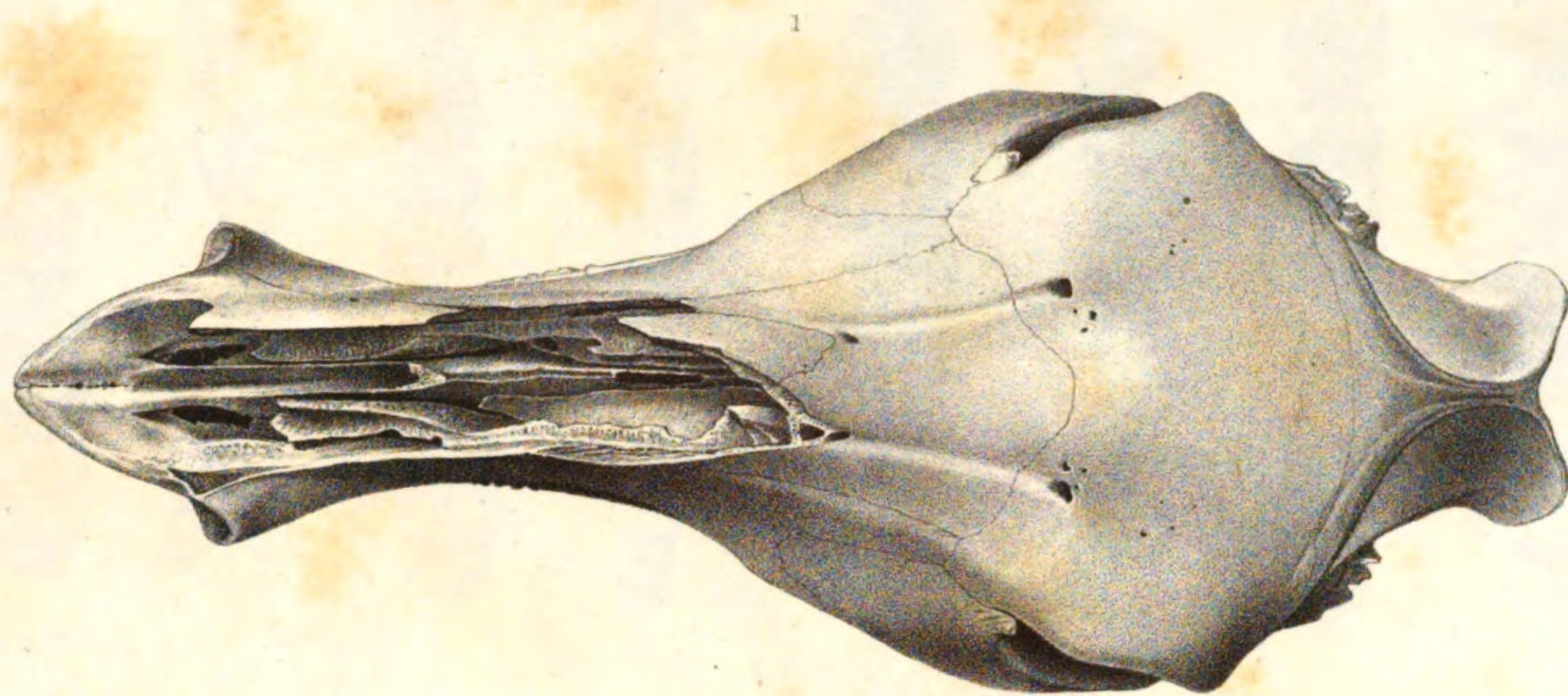


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EUCHŒRUS MACROPS. Leidy

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J. Audubon del.



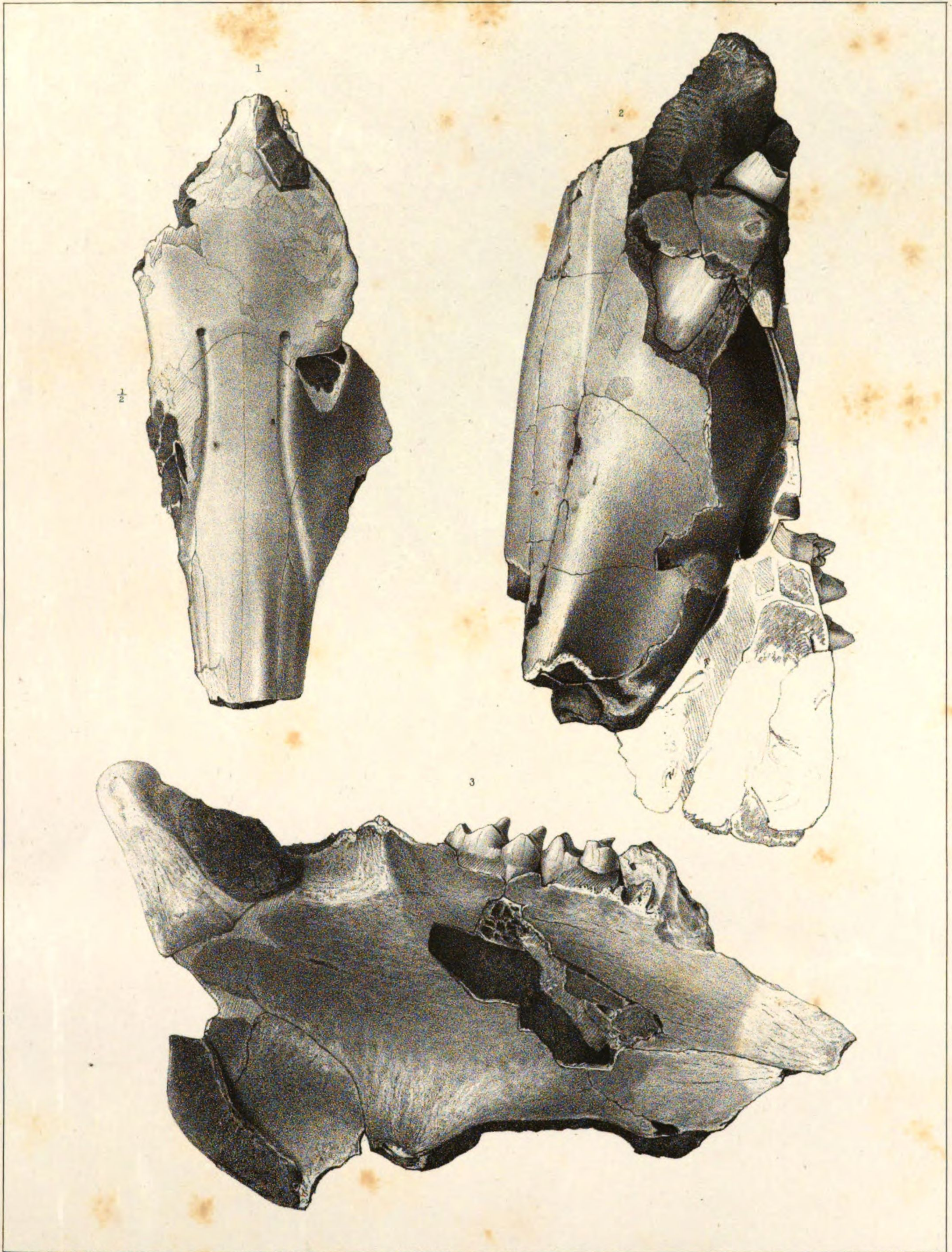
From nature by A. J. Boulton.

F. Soudaire lith.

Euchoerus macrops Leidy.



1-4. *Dicotyles torquatus*. 5-8, 17, 19, *Euchoerus macrops*.
9-16. *Platygonus compressus*. 18. *Protochoerus prismaticus*.



From nature by A. J. Hooten.

F. Hartman del. Phila.

*1. Dicotyles depressifrons Le Conte.
2.3. Platygonus compressus Le Conte.*

Leidy, Joseph

On the extinct Species of American Ox (From the Smithsonian Contributions
to knowledge, Vol. V.)

Philadelphia 1852

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